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Subject Revised Phase 1a Addendum Report - Part 2

History: This message has been forwarded.

All - here are the revised tables:

- Table 3-2 water levels
- Table 3-3 Chlorinated VOCs in GW
- Table 3-4 Aromatic VOCs in GW
- Table 3-7 1,4-Dioxane, etc. in GW
- Table 3-8 Natural Attenuation
- Table 3-10 VOCs and 1,4-dioxane in Soil
- Table 3-11 Aquifer Parameters
- Table H-1 Appendix H (Validation)

Also attached are the following:

- three data validation reports (Aug. 03 through Aug. 04)
- report text (I fixed a typo in the TOC, page ii)

New lithologic logs and Appendices E, F and G will be transmitted next.



Tab_3_2.xls



Table 3-10.pdf



Tab_3_3.pdf



Tab_3_4.pdf



Tab_3_7.pdf



tab_3_11.pdf



OmegaVAL_Feb04.doc



OmegaVAL_Aug03.doc



OmegaVAL_Aug04.doc



Rev_Report to EPA.doc

Table 3-2
Omega Chemical Superfund Site
Groundwater Elevation Summary

Date	Well ID	OW-1	OW-1b	OW-2	OW-3	OW-4a	OW-4b	OW-5	OW-6	OW-7	OW-8	OW8-b
	TOC Elev (ft MSL)	210.30	204.98	200.10	196.33	182.47	182.22	151.96	170.54	212.01	198.42	198.65
5/15/2001	DTW (ft btoc)	74.19	72.30	66.47	62.55	53.60	57.11	--	--	--	--	--
	GW Elev (ft MSL)	136.11	132.68	133.63	133.78	128.87	125.11	--	--	--	--	--
6/14/2001	DTW (ft btoc)	74.14	72.53	66.38	62.44	53.36	57.51	--	--	--	--	--
	GW Elev (ft MSL)	136.16	132.45	133.72	133.89	129.11	124.71	--	--	--	--	--
7/24/2001	DTW (ft btoc)	74.04	73.36	66.25	62.29	53.31	58.82	--	--	--	--	--
	GW Elev (ft MSL)	136.26	131.62	133.85	134.04	129.16	123.40	--	--	--	--	--
8/16/2001	DTW (ft btoc)	74.08	74.18	66.34	62.39	53.70	60.01	26.14	42.54	--	--	--
	GW Elev (ft MSL)	136.22	130.80	133.76	133.94	128.77	122.21	125.82	128.00	--	--	--
9/18/2001	DTW (ft btoc)	74.33	74.75	66.66	62.70	54.35	60.82	27.33	43.25	--	--	--
	GW Elev (ft MSL)	135.97	130.23	133.44	133.63	128.12	121.40	124.63	127.29	--	--	--
10/18/2001	DTW (ft btoc)	74.84	74.83	66.95	62.98	54.76	60.98	27.59	43.69	--	--	--
	GW Elev (ft MSL)	135.46	130.15	133.15	133.35	127.71	121.24	124.37	126.85	--	--	--
11/15/2001	DTW (ft btoc)	74.38	75.49	66.92	62.95	54.87	61.67	28.18	43.95	--	--	--
	GW Elev (ft MSL)	135.92	129.49	133.18	133.38	127.60	120.55	123.78	126.59	--	--	--
12/14/2001	DTW (ft btoc)	74.80	75.05	67.28	63.33	55.43	60.76	28.24	44.41	--	--	--
	GW Elev (ft MSL)	135.50	129.93	132.82	133.00	127.04	121.46	123.72	126.13	--	--	--
1/18/2002	DTW (ft btoc)	74.92	74.12	67.40	63.52	55.55	59.53	27.44	44.39	--	--	--
	GW Elev (ft MSL)	135.38	130.86	132.70	132.81	126.92	122.69	124.52	126.15	--	--	--
2/14/2002	DTW (ft btoc)	74.86	73.56	67.31	63.36	55.21	58.81	26.73	44.00	--	--	--
	GW Elev (ft MSL)	135.44	131.42	132.79	132.97	127.26	123.41	125.23	126.54	--	--	--
3/13/2002	DTW (ft btoc)	75.13	74.52	67.50	63.58	55.30	59.34	26.75	44.01	74.83	65.61	--
	GW Elev (ft MSL)	135.17	130.46	132.60	132.75	127.17	122.88	125.21	126.53	137.18	132.81	--
4/19/2002	DTW (ft btoc)	75.16	NM	67.52	63.61	55.35	60.02	27.12	44.12	74.93	65.69	--
	GW Elev (ft MSL)	135.14	NM	132.58	132.72	127.12	122.20	124.84	126.42	137.08	132.73	--
8/20/2002	DTW (ft btoc)	75.97	77.04	68.30	64.47	56.80	63.64	30.03	45.70	75.86	66.46	--
	GW Elev (ft MSL)	134.33	127.94	131.80	131.86	125.67	118.58	121.93	124.84	136.15	131.96	--
2/19/2003	DTW (ft btoc)	76.70	77.04	69.44	65.58	58.58	62.46	30.85	47.49	76.89	67.37	--
	GW Elev (ft MSL)	133.60	127.94	130.66	130.75	123.89	119.76	121.11	123.05	135.12	131.05	--
8/26/2003	DTW (ft btoc)	76.95	78.75	69.18	65.54	58.13	65.67	31.20	47.09	76.90	67.35	--
	GW Elev (ft MSL)	133.35	126.23	130.92	130.79	124.34	116.55	120.76	123.45	135.11	131.07	--
02/2004	DTW (ft btoc)	76.97	80.93	70.40	66.35	61.04	68.08	35.21	50.24	78.00	68.36	--
	GW Elev (ft MSL)	133.33	124.05	129.70	129.98	121.43	114.14	116.75	120.30	134.01	130.06	--
08/2004	DTW (ft btoc)	78.84	82.80	71.24	67.13	62.36	71.10	36.78	51.69	78.96	69.15	86.77
	GW Elev (ft MSL)	131.46	122.18	128.86	129.20	120.11	111.12	115.18	118.85	133.05	129.27	111.88

TOC - Top of Casing

Elev - Elevation

ft MSL - feet mean sea level

DTW - Depth to Water

ft btoc - feet below top of casing

GW Elev - Groundwater Elevation

Note: February 2004 measurements collected February 24, 25 and 27. August 2004 measurements collected August 24 through 26.

Table 3-10
Omega Chemical Superfund Site
Volatile Organic Compounds (VOCs) and 1,4-Dioxane Analytical Summary
Soil Analytical Results

Boring Number	Sample Date	Sample Depth (ft bgs)	Sample Type	PCE	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1-DCA	1,2-DCA	CFM	MC	Freon 11	Acetone	Benzene	Toluene	1,4-Dioxane
GP1	10/27/03	60	ORIG	4600	130	83 U	83 U	210 U	83 U	83 U	83 U	83 U	83 U	830 U	210 U	1200 U	83 U	83 U	25 U
	10/27/03	75	ORIG	4100	100	84 U	84 U	210 U	84 U	84 U	84 U	84 U	84 U	840 U	210 U	1300 U	84 U	84 U	25 U
	10/27/03	85	ORIG	100	4.5	1.6 U	1.6 U	4 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	16 U	4 U	8 U	1.6 U	1.6 U	25 U
GP2	10/28/03	65	ORIG	4200	180	82 U	82 U	200 U	82 U	82 U	82 U	82 U	82 U	820 U	200 U	1200 U	82 U	82 U	25 U
	10/28/03	65	DUP	4000	170	80 U	80 U	200 U	80 U	80 U	80 U	80 U	80 U	800 U	200 U	1200 U	80 U	80 U	25 U
	10/28/03	77	ORIG	1500	82 U	82 U	82 U	200 U	82 U	82 U	82 U	82 U	82 U	820 U	200 U	1200 U	82 U	82 U	25 U
	10/28/03	79	ORIG	1700	100 U	100 U	100 U	250 U	100 U	100 U	100 U	100 U	100 U	1000 U	250 U	1500 U	100 U	100 U	25 U
GP3A	10/28/03	10	ORIG	3200	85 U	85 U	85 U	210 U	85 U	85 U	85 U	85 U	85 U	850 U	210 U	1300 U	85 U	85 U	10000
	10/28/03	20	ORIG	300	9	16	4.3	4.2 U	1.7 U	1.7 U	3.6	40	2.8	17 U	4.2 U	8.3 U	1.7 U	1.7 U	1300
	10/28/03	32	ORIG	130	6.9	5.8	7.2	5 U	2 U	2 U	3.4	120	3.8	20 U	5 U	12	2 U	2 U	300
	10/28/03	45	ORIG	3800	140	78 U	78 U	200 U	78 U	78 U	78 U	220	78 U	780 U	200 U	1200 U	78 U	78 U	25 U
	10/28/03	55	ORIG	5600	130	81 U	81 U	200 U	81 U	81 U	81 U	110	81 U	810 U	200 U	1200 U	81 U	81 U	25 U
	10/28/03	65	ORIG	12000	190	130	100 U	250 U	100 U	100 U	100 U	140	100 U	1000 U	250 U	1500 U	100 U	100 U	25 U
	10/28/03	78	ORIG	13	2 U	2 U	2 U	5 U	2 U	2 U	2 U	2.1	2 U	20 U	5 U	10 U	2 U	2 U	25 U
	10/28/03	85	ORIG	970	83 U	83 U	83 U	210 U	83 U	83 U	83 U	83 U	83 U	830 U	210 U	1200 U	83 U	83 U	25 U
GP4	01/20/04	20	ORIG	100	7.1	2.6	1.8 U	4.5 U	1.8 U	1.8 U	1.8 U	3.2	5.7	18 U	4.5 U	9 U	1.8 U	1.8 U	170
	01/20/04	35	ORIG	4200	30	5.1	6.7	13	1.7 U	1.7 U	7.3	14	28	17 U	4.3 U	8.6 U	3.1	1.7 U	59
	01/20/04	48	ORIG	4300	74	15	19	36	2 U	2 U	19	30	65	20 U	5 U	10 U	5.6	2 U	25 U
	01/21/04	68	ORIG	48000	430	340	140	210 U	84 U	84 U	84 U	84 U	110	840 U	210 U	1300 U	84 U	84 U	25 U
GP5	01/20/04	18	ORIG	2500	100 U	100 U	100 U	250 U	100 U	100 U	100 U	100 U	100 U	1000 U	250 U	1500 U	100 U	100 U	35
	01/20/04	32	ORIG	4300	48	2.2 U	2.2 U	15	14	2.2 U	5.2	2.2 U	62	22 U	5.6 U	11 U	2.2 U	2.2 U	140
	01/20/04	54	ORIG	6800	79	4.9	2 U	34	21	2 U	10	3.3	280	20 U	5 U	10 U	2 U	3	25 U
	01/20/04	68	ORIG	3700	67	12	1.9	45	10	2	9	23	310	18 U	4.4 U	8.8 U	1.8 U	1.8 U	
	01/20/04	73	ORIG																1500
GP6	01/22/04	25	ORIG	130	3.2	1.6 U	1.6 U	10	1.8	1.6 U	1.6 U	1.6 U	1.9	16 U	4 U	8.1 U	1.6 U	1.6 U	25 U
	01/22/04	50	ORIG	8500	34	35	1.7 U	39	2	1.7 U	5.1	3.9	15	17 U	4.2 U	8.5 U	1.7 U	1.7 U	25 U

Table 3-10
Omega Chemical Superfund Site
Volatile Organic Compounds (VOCs) and 1,4-Dioxane Analytical Summary
Soil Analytical Results

Boring Number	Sample Date	Sample Depth (ft bgs)	Sample Type	PCE	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1-DCA	1,2-DCA	CFM	MC	Freon 11	Acetone	Benzene	Toluene	1,4-Dioxane
GP6	01/22/04	70	ORIG	11000	42	91	16 U	39	16 U	16 U	17	27	66	16 U	39 U	79 U	16 U	16 U	25 U
GP7	01/21/04	45	ORIG	230	16	17 U	17 U	10	17 U	17 U	31	22	32	17 U	42 U	85 U	17 U	17 U	25 U
	01/21/04	60	ORIG	6200	110	66	42	85	24	49	15	2	190	59	5 U	10 U	21	2 U	25 U
	01/21/04	65	ORIG	11000	130	10	79	110	21	71	17	5	210	16 U	57	8 U	23	16 U	25 U
GP8	01/21/04	50	ORIG	7000	29	18 U	18 U	14	18 U	18 U	18 U	19	30	19	44 U	89 U	18 U	18 U	25 U
	01/21/04	60	ORIG	51	44	16 U	16 U	41 U	16 U	16 U	16 U	16 U	13	16 U	41 U	82 U	16 U	16 U	25 U
	01/21/04	66	ORIG	56	2 U	2 U	2 U	5 U	2 U	2 U	2 U	2 U	29	20 U	5 U	10 U	2 U	2 U	25 U

Notes

Concentrations are reported in micrograms per kilogram (ug/kg)
Only compounds detected in one or more soil samples are shown
VOCs analyzed by EPA Method 8260
1,4-Dioxane analyzed using EPA Method 8270C (modified)

U = Not detected at a concentration greater than the reporting limit shown

Sample Type

ORIG = Original sample
DUP = Duplicate sample

PCE = Tetrachloroethene, TCE = Trichloroethene, TCA = Trichloroethane, DCE = Dichloroethene, DCA = Dichloroethane, CFM = Chloroform, MC = Methylene chloride, Freon 11 = Trichlorofluoromethane

Table 3-3
Omega Chemical Superfund Site
Chlorinated VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	PCE (5)	TCE (5)	1,1,1- TCA (200)	1,1,2- TCA (5)	PCA	1,1-DCE (6)	cis- 1,2-DCE (6)	trans- 1,2-DCE (10)	1,1-DCA (5)	1,2-DCA (0.5)	1,2-DCB (600)	1,4-DCB (5)	CBN (70)	CTC (0.5)	CFM (80)	MC (5)	Freon 113 (1200)	Freon 11 (150)	Freon 12 (1000#)	VC (0.5)
OW1 62.5 - 77.5																						
	06/06/1996	ORIG	81000	3400	12000	500 U		3600	500 U	500 U	500 U	2600	500 U	500 U	500 U	500 U	3200	15000	1400	990		500 U
	07/02/1999	ORIG	23000	1300	2100	4.6	2.6	1200	5.4	160	86	120	0.97	1 U	2	3.6	400	110	1300	550	5 U	2.1
	05/16/2001	ORIG	86000	2400	8900	20 U	20 U	2700	20 U	100	130	87	20 U	20 U	20 U	10 U	500	490	720	410	100 U	10 U
	05/16/2001	N	3.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/17/2001	ORIG	54000	2000	5800	100 U	100 U	2100	100 U	100 U	100 U	62	100 U	100 U	100 U	50 U	380	500 U	1400	620	500 U	50 U
	11/15/2001	ORIG	33000	1200	2200	2.2	4.7	1300	4	74	54	40	1 U	1 U	1.8	0.5 U	280	21	1400	590	5 U	0.5 U
	02/14/2002	ORIG	30000	1200	2200	100 U	100 U	1200	100 U	100 U	100 U	50 U	100 U	100 U	100 U	50 U	280	500 U	1300	480	500 U	50 U
	08/20/2002	ORIG	42000	1900	3100	200 U	200 U	1300	200 U	200 U	200 U	100 U	200 U	200 U	200 U	100 U	320	1000 U	1100	600	1000 U	100 U
	08/20/2002	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/19/2003	ORIG	100000	3000	10000	4.7	32	2600	8.6	39	88	84	15	3	7.8	0.5 U	500	72	510	120	5 U	0.5 U
	08/26/2003	ORIG	110000	2200	7000	1.4	19	1600	7.2	43	71	53	4.5	1.2	4.1	0.5 U	360	42	380	170	5 U	0.5 U
	02/24/2004	ORIG	150000	3600	9600	0.58 J	12	2100	4.5	21	52	22	7	1.7	3.4	1	81	53	380 J	55	5 U	0.64
	08/27/2004	ORIG	110000	2300	8500	400 U	400 U	1900	400 U	400 U	400 U	200 U	400 U	400 U	400 U	200 U	400 U	2000 U	2000 U	400 U	2000 U	200 U
	08/27/2004	DUP	150000	3500	12000	0.35 J	5.3	2000	4.6	15	45	12	3.8	0.89 J	1.9	0.44 J	59	41	150	22	5 U	0.5 U
OW1b 110 - 120																						
	07/02/1999	ORIG	180 R	11	7.4	0.5 U	1 U	11	0.5 U	0.65	2.4	8.8	0.5 U	1 U	1 U	0.5 U	6.6	10 U	12	2.9	5 U	0.5 U
	07/02/1999	N	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	0.5 U	1 U	10 U	5 U	0.5 U	5 U	0.5 U
	07/02/1999	DUP	300	14	7.8	0.5 U	1 U	13	0.5 U	0.78	2.8	10	0.5 U	1 U	1 U	0.5 U	7.7	10 U	12	3	5 U	0.5 U
	05/16/2001	ORIG	62	2.4	1 U	1 U	1 U	1.9	2.7	1 U	1 U	2.9	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	05/16/2001	DUP	56	1.9	1 U	1 U	1 U	1 U	2.4	1 U	1 U	2.2	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/17/2001	ORIG	29	1 U	1 U	1 U	1 U	1 U	1.7	1 U	1 U	1.2	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	11/16/2001	ORIG	60	5.6	6	1 U	1 U	1.6	1.4	1 U	1 U	1	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/14/2002	ORIG	28	1 U	1 U	1 U	1 U	1 U	1.1	1 U	1 U	0.69	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/20/2002	ORIG	41	1.4	1 U	1 U	1 U	1.1	1 U	1 U	1 U	0.76	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/19/2003	ORIG	45	2.2	1 U	1 U	1 U	3.1	1 U	1 U	1 U	0.64	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.6
	08/26/2003	ORIG	110	3.5	1.5	1 U	1 U	2.9	1 U	1 U	1 U	1.4	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/24/2004	ORIG	77	3.9	0.3 J	1 U	1 U	3.4	0.45 J	1 U	0.43 J	0.87	1 U	1 U	1 U	0.5 U	1.1	0.8 J	4.8 J	1.8	5 U	0.5 U
	08/27/2004	ORIG	87	2.8	0.84 J	1 U	1 U	2.2	1 U	1 U	1 U	0.41 J	1 U	1 U	1 U	0.5 U	0.59 J	1.2 UJB	2.5 J	1	5 U	0.5 U

Table 3-3
Omega Chemical Superfund Site
Chlorinated VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	PCE (5)	TCE (5)	1,1,1- TCA (200)	1,1,2- TCA (5)	PCA	1,1-DCE (6)	cis- 1,2-DCE (6)	trans- 1,2-DCE (10)	1,1-DCA (5)	1,2-DCA (0.5)	1,2-DCB (600)	1,4-DCB (5)	CBN (70)	CTC (0.5)	CFM (80)	MC (5)	Freon 113 (1200)	Freon 11 (150)	Freon 12 (1000#)	VC (0.5)
OW2 60 - 80																						
	07/02/1999	ORIG	1300	240	8.5	2 U	4 U	680	2 U	2 U	2.8	2 U	2 U	4 U	4 U	2 U	4 U	40 U	2600	610	20 U	2 U
	05/15/2001	ORIG	780	150	10 U	10 U	10 U	500	10 U	10 U	10 U	5 U	10 U	10 U	10 U	5 U	10 U	50 U	1100	370	50 U	5 U
	08/17/2001	ORIG	620	110	2	1 U	1 U	360	1 U	1 U	1.1	0.5 U	1 U	1 U	1 U	0.57	1 U	5 U	1400	330	5 U	0.5 U
	11/16/2001	ORIG	730	130	2.6	1 U	1 U	390	1 U	1 U	1.5	0.5 U	1 U	1 U	1 U	0.61	1 U	5 U	1600	390	5 U	0.5 U
	02/15/2002	ORIG	710	110	2.1	1 U	1 U	350	1 U	1 U	1.5	0.5 U	1 U	1 U	1 U	0.79	1.2	5 U	1400	380	5 U	0.5 U
	08/21/2002	ORIG	610	120	4 U	4 U	4 U	350	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	4 U	20 U	1400	310	20 U	2 U
	02/19/2003	ORIG	1300	150	5.9	1 U	1 U	790	1 U	1 U	1.9	0.5 U	1 U	1 U	1 U	0.5 U	1.9	5 U	820	280	5 U	0.5 U
	03/10/2003	ORIG	1400	160	3.7	2 U	2 U	680	2 U	2 U	2.1	1 U	2 U	2 U	2 U	1 U	2.5	10 U	660	240	10 U	1 U
	08/27/2003	ORIG	2000	230	5 U	5 U	5 U	870	5 U	5 U	5 U	2.5 U	5 U	5 U	5 U	2.5 U	5 U	25 U	750	290	25 U	2.5 U
	02/24/2004	ORIG	2500	200	4.2 J	5 U	5 U	930	5 U	5 U	2.5 J	2.5 U	5 U	5 U	5 U	2.5 U	3.4 J	25 U	420	180	25 U	2.5 U
	08/24/2004	ORIG	2800	300	3.3 J	10 U	10 U	1000	10 U	10 U	2.9 J	5 U	10 U	10 U	10 U	5 U	4.4 J	50 U	670	300	50 U	5 U
OW3 63 - 83																						
	07/02/1999	ORIG	670	170	28	2 U	4 U	1200	2 U	2 U	2 U	2 U	2 U	4 U	4 U	2 U	4 U	40 U	800	410	20 U	2 U
	05/16/2001	ORIG	2100	270	33	20 U	20 U	1700	20 U	20 U	20 U	10 U	20 U	20 U	20 U	10 U	20 U	100 U	430	380	100 U	10 U
	08/17/2001	ORIG	1800	200	22	4 U	4 U	1500	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	12	20 U	520	330	20 U	2 U
	11/15/2001	ORIG	1300	180	17	1 U	1 U	1200	1 U	1 U	1.6	0.5 U	1 U	1 U	1 U	0.66	6.5	5 U	530	300	5 U	0.5 U
	02/15/2002	ORIG	1400	180	14	4 U	4 U	1100	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	7.7	20 U	530	280	20 U	2 U
	08/20/2002	ORIG	200	160	12	4 U	4 U	130	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	7.4	20 U	360	230	20 U	2 U
	02/20/2003	ORIG	1500	170	9.5	4 U	4 U	1100	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	7	20 U	450	320	20 U	2 U
	02/20/2003	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	03/13/2003	ORIG	1800	170	8.9	4 U	4 U	1400	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	6.8	20 U	430	250	20 U	2 U
	08/26/2003	ORIG	2100	190	9.4	1 U	1 U	1100	1 U	1 U	2	0.5 U	1 U	1 U	1 U	0.5 U	9.5	5 U	370	300	5 U	0.5 U
	02/25/2004	ORIG	2800	260	11	10 U	10 U	1500	10 U	10 U	2.8 J	5 U	10 U	10 U	10 U	5 U	14	50 U	390	230	50 U	5 U
	02/25/2004	DUP	3200	290	12	10 U	10 U	1700	10 U	10 U	3.7 J	5 U	10 U	10 U	10 U	5 U	16	8.3 J	400	290	50 U	5 U
	08/24/2004	ORIG	2200	250	7.4	5 U	5 U	1200	5 U	5 U	2.6 J	2.5 U	5 U	5 U	5 U	2.5 U	16	12 J	340	270	25 U	2.5 U
OW4A 49.8 - 69.8																						
	05/16/2001	ORIG	1000	120	20 U	20 U	20 U	1500	20 U	20 U	20 U	10 U	20 U	20 U	20 U	10 U	39	100 U	580	260	100 U	10 U
	08/16/2001	ORIG	1300	180	21	1 U	1 U	2400	1 U	1 U	1.7	3.5	1 U	1 U	1 U	1	62	5 U	910	340	5.8	0.5 U

Table 3-3
Omega Chemical Superfund Site
Chlorinated VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	PCE (5)	TCE (5)	1,1,1- TCA (200)	1,1,2- TCA (5)	PCA	1,1-DCE (6)	cis- 1,2-DCE (6)	trans- 1,2-DCE (10)	1,1-DCA (5)	1,2-DCA (0.5)	1,2-DCB (600)	1,4-DCB (5)	CBN (70)	CTC (0.5)	CFM (80)	MC (5)	Freon 113 (1200)	Freon 11 (150)	Freon 12 (1000#)	VC (0.5)
	11/16/2001	ORIG	9.8	30	1 U	1 U	1 U	10	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	32	5 U	5.3	2.2	5 U	0.5 U
	11/16/2001	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/15/2002	ORIG	130	48	1.6	1 U	1 U	230	1 U	1 U	1 U	0.69	1 U	1 U	1 U	0.5 U	33	5 U	160	62	5 U	0.5 U
	02/15/2002	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/21/2002	ORIG	87	50	1 U	1 U	1 U	120	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	37	5 U	88	44	5 U	0.5 U
	02/20/2003	ORIG	37	30	1 U	1 U	1 U	79	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	21	5 U	53	23	5 U	0.5 U
	03/14/2003	ORIG	250	25	1 U	1 U	1 U	210	1 U	1 U	1 U	0.77	1 U	1 U	1 U	0.5 U	13	5 U	150	69	5 U	0.5 U
	08/27/2003	ORIG	67	32	1 U	1 U	1 U	100	1 U	1 U	1 U	0.5	1 U	1 U	1 U	0.5 U	21	5 U	5 U	32	5 U	0.5 U
	02/27/2004	ORIG	12	31	1 U	1 U	1 U	14	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	22	5 U	11	7	5 U	0.5 U
	08/25/2004	ORIG	68	12	0.3 J	1 U	1 U	140	1 U	1 U	1 U	0.45 J	1 U	1 U	1 U	0.5 U	6.4	1.1 J	230	100	0.87 J	0.5 U
	08/25/2004	DUP	75	13	0.32 J	1 U	1 U	130	1 U	1 U	1 U	0.43 J	1 U	1 U	1 U	0.5 U	6.7	1 J	230	120	0.94 J	0.5 U
OW4B	112 - 122.3																					
	04/03/2001	ORIG	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	05/16/2001	ORIG	1.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/16/2001	ORIG	1.2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	11/16/2001	ORIG	1.9	1 U	1 U	1 U	1 U	1.2	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/15/2002	ORIG	1.9	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/21/2002	ORIG	12	7.9	1 U	1 U	1 U	22	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	86	14	5 U	0.5 U
	02/20/2003	ORIG	41	3.7	1 U	1 U	1 U	14	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	30	1 U	5 U	0.5 U
	08/27/2003	ORIG	33	3	1 U	1 U	1 U	12	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	30	2	5 U	0.5 U
	02/27/2004	ORIG	14	0.31 J	1 U	1 U	1 U	1.4	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	4.2 J	1 U	5 U	0.5 U
	08/25/2004	ORIG	1.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1.5 J	5 U	1 U	5 U	0.5 U
OW5	30 - 50																					
	08/17/2001	ORIG	150	510	2 U	2 U	2 U	22	31	2 U	2 U	1 U	2 U	2 U	2 U	1 U	2 U	10 U	220	52	10 U	1 U
	08/17/2001	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/17/2001	DUP	190	550	1 U	1 U	1 U	35	36	1.4	1 U	0.5 U	1 U	1 U	1 U	0.5 U	2.4	5 U	240	66	5 U	0.5 U
	11/16/2001	ORIG	130	470	1 U	1 U	1 U	24	26	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	2.1	5 U	180	46	5 U	0.5 U
	11/16/2001	DUP	130	570	1 U	1 U	1 U	18	30	1.6	1 U	0.5 U	1 U	1 U	1 U	0.5 U	2.3	5 U	170	47	5 U	0.5 U
	02/15/2002	ORIG	130	390	1 U	1 U	1 U	22	30	1.3	1 U	0.5 U	1 U	1 U	1 U	0.5 U	2	5 U	230	40	5 U	0.5 U

Table 3-3
Omega Chemical Superfund Site
Chlorinated VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	PCE (5)	TCE (5)	1,1,1- TCA (200)	1,1,2- TCA (5)	PCA	1,1-DCE (6)	cis- 1,2-DCE (6)	trans- 1,2-DCE (10)	1,1-DCA (5)	1,2-DCA (0.5)	1,2-DCB (600)	1,4-DCB (5)	CBN (70)	CTC (0.5)	CFM (80)	MC (5)	Freon 113 (1200)	Freon 11 (150)	Freon 12 (1000#)	VC (0.5)
	02/15/2002	DUP	120	410	1 U	1 U	1 U	18	32	1.8	1 U	0.5 U	1 U	1 U	1 U	0.5 U	2.1	5 U	230	39	5 U	0.5 U
	08/22/2002	ORIG	150	300	1 U	1 U	1 U	37	34	1.2	1 U	0.5 U	1 U	1 U	1 U	0.5 U	2.1	5 U	200	61	5 U	0.5 U
	02/21/2003	ORIG	440	810	1 U	1 U	1 U	98	97	5.1	1 U	2.6	1 U	1 U	1 U	0.5 U	26	5 U	470	120	5 U	0.5 U
	08/28/2003	ORIG	25	34	1 U	1 U	1 U	5.4	3.6	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1.3	5 U	5 U	2.7	5 U	0.5 U
	02/24/2004	ORIG	1500	420	3.1	0.91 J	1 U	390	33	2.9	3.8	26	1 U	1 U	1 U	0.5 U	160	20	450	190	5 U	0.5 U
	08/25/2004	ORIG	1800	320	2.6	1.2	1 U	910	14	3.2	5.1	33	1 U	1 U	1 U	0.5 U	300	29	900	360	1.8 J	0.5 U
OW6	38 - 58																					
	05/16/2001	ORIG	28	4	4 U	4 U	4 U	39	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	4 U	20 U	160	96	20 U	2 U
	08/17/2001	ORIG	24	4 U	4 U	4 U	4 U	39	4 U	4 U	4 U	2 U	4 U	4 U	4 U	2 U	4 U	20 U	180	93	20 U	2 U
	11/16/2001	ORIG	140	22	2.9	1 U	1 U	190	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	5.7	5 U	770	440	5 U	0.5 U
	02/15/2002	ORIG	69	13	1.3	1 U	1 U	120	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1.1	3.2	5 U	530	190	5 U	0.5 U
	08/21/2002	ORIG	21	3.9	1 U	1 U	1 U	35	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1.1	5 U	140	95	5 U	0.5 U
	02/21/2003	ORIG	72	15	1 U	1 U	1 U	91	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.71	3.3	5 U	460	350	5 U	0.5 U
	08/28/2003	ORIG	22	3.6	1 U	1 U	1 U	39	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	9.3	340	120	5 U	0.5 U
	02/25/2004	ORIG	17	2.5	1 U	1 U	1 U	16	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.83 J	5 U	62	46	5 U	0.5 U
	02/25/2004	N	1.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	0.53 J	5 U	1 U	5 U	0.5 U
	08/25/2004	ORIG	18	0.87 J	1 U	1 U	1 U	3.8	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.47 J	1.9 J	16	9.4	5 U	0.5 U
OW7	70.9 - 90.9																					
	03/27/2002	ORIG	5.6	1.2	1 U	1 U	1 U	0.61 J	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	62	36	5 U	0.5 U
	03/27/2002	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	0.23 J	5 U	1 U	5 U	0.5 U
	08/21/2002	ORIG	8.2	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	51	44	5 U	0.5 U
	02/21/2003	ORIG	12	1.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	44	36	5 U	0.5 U
	08/26/2003	ORIG	7.9	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	63	54	5 U	0.5 U
	02/25/2004	ORIG	20	1.4	1 U	1 U	1 U	0.94 J	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	52	34	5 U	0.5 U
	08/25/2004	ORIG	7.4	1.3	1 U	1 U	1 U	0.4 J	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	32	29	5 U	0.5 U
OW8	60.4 - 80																					
	03/27/2002	ORIG	11000	930	50	33	2.2	1600	6.3	92	48	110	1.7	1 U	1.2	0.5 U	390	36	2500	820	1.9 J	0.5 U
	08/22/2002	ORIG	9400	910	49	20 U	20 U	1700	20 U	81	46	49	20 U	20 U	20 U	10 U	350	100 U	2100	1000	100 U	10 U
	08/22/2002	DUP	10000	840	47	25	1.9	1500	9.7	66	45	86	1.2	1 U	1.1	0.5 U	340	140	5 U	910	5 U	0.5 U

Table 3-3
Omega Chemical Superfund Site
Chlorinated VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	PCE (5)	TCE (5)	1,1,1- TCA (200)	1,1,2- TCA (5)	PCA	1,1-DCE (6)	cis- 1,2-DCE (6)	trans- 1,2-DCE (10)	1,1-DCA (5)	1,2-DCA (0.5)	1,2-DCB (600)	1,4-DCB (5)	CBN (70)	CTC (0.5)	CFM (80)	MC (5)	Freon 113 (1200)	Freon 11 (150)	Freon 12 (1000#)	VC (0.5)
	02/20/2003	ORIG	11000	910	50	39	20 U	1200	20 U	58	46	240	20 U	20 U	20 U	10 U	550	930	2300	1000	100 U	10 U
	02/20/2003	DUP	13000	1000	48	58	25 U	1300	25 U	73	60	310	25 U	25 U	25 U	12 U	790	2400	2500	990	120 U	12 U
	03/11/2003	ORIG	34000	2200	390	100 U	100 U	2600	100 U	110	100	820	100 U	100 U	100 U	50 U	2000	6500	2800	810	500 U	50 U
	03/11/2003	DUP	36000	2100	380	100 U	100 U	2500	100 U	100 U	100 U	790	100 U	100 U	100 U	50 U	2000	6300	2600	820	500 U	50 U
	08/27/2003	ORIG	12000	880	40	25 U	25 U	1500	25 U	46	39	140	25 U	25 U	25 U	12 U	420	120 U	1600	580	120 U	12 U
	08/27/2003	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	08/27/2003	DUP	14000	990	42	40 U	40 U	1700	40 U	43	42	150	40 U	40 U	40 U	20 U	480	200 U	1500	560	200 U	20 U
	11/20/2003	ORIG	35000	1600	290	41	1.7	1900	15	60	67	470	8.9	1 U	3	0.5 U	1300	2500	1700	540	5 U	0.5 U
	02/24/2004	ORIG	17000	1000	35 J	52	50 U	1400	50 U	68	56	350	50 U	50 U	50 U	25 U	670	1700	2200	730	250 U	25 U
	08/24/2004	ORIG	3400	1600	51 J	130	100 U	1300	100 U	100	110	780	100 U	100 U	100 U	50 U	1700	6300	2200	800	500 U	50 U
	08/24/2004	N	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	15	5 U	1 U	5 U	0.5 U
OW8B	116 - 126																					
	08/24/2004	ORIG	2.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
QC	-																					
	08/21/2002	M	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/19/2003	M	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/20/2003	M	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U
	02/21/2003	M	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	5 U	5 U	1 U	5 U	0.5 U

Notes.

Concentrations are reported in micrograms per liter (ug/l).
Only chlorinated compounds detected above laboratory reporting limits in one or more groundwater samples are listed.
Samples analyzed by EPA Methods 502.2, 8240 or 8260.
If blank, analyte was either not reported or not analyzed

Screened interval is shown in feet below ground surface.

U = Not detected at a concentration greater than the reporting limit shown.
J = Estimated concentration below reporting limit.
H = Estimated result; sample analyzed after holding time
R = Result not usable based on data validation
B = Analyte also detected in laboratory method blank.

PCE = Tetrachloroethene; TCE = Trichloroethene; TCA = Trichloroethane; PCA = 1,1,1,2-Tetrachloroethane; DCE = Dichloroethene; DCA = Dichloroethane; DCB = Dichlorobenzene; CBN = Chlorobenzene; CTC = Carbon tetrachloride; CFM = Chloroform; MC = Methylene chloride; Freon 113 = 1,1,2-Trichloro-1,2,2-trifluoroethane; Freon 11 = Trichlorofluoromethane, Freon 12 = Dichlorodifluoromethane, and VC = Vinyl chloride

Sample Type:
ORIG = Original sample
DUP = Duplicate sample
M = Trip Blank
N = Equipment decontamination blank

California Maximum Contaminant Levels (MCLs) are shown in parenthesis
= California Action Level

Table 3-4
Omega Chemical Superfund Site
Aromatic and Other VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Benzene (1)	Toluene (150)	Ethyl benzene (300)	m,p- Xylenes (1750)	o- Xylene (1750)	sec-Butyl benzene (260#)	Isopropyl benzene (770#)	1,2,4-Trimethyl benzene (330#)	1,3,5-Trimethyl benzene (330#)	Acetone	2-Propanol	MTBE (13)	Naphthalene (17#)
OW1	62.5 - 77.5														
	06/06/1996	ORIG	500 U	500 U	500 U	2000 U	2000 U					10000 U			
	07/02/1999	ORIG	10	14	1.5	1.5	3	0.5 U	1 U	1 U	1 U	10 U			1 U
	05/16/2001	ORIG	15	23	20 U	20 U	20 U	20 U	20 U	20 U	20 U	200 U		20 U	20 U
	05/16/2001	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/17/2001	ORIG	50 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	1000 U		100 U	100 U
	11/15/2001	ORIG	7.5	2.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/14/2002	ORIG	50 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	1000 U		100 U	100 U
	08/20/2002	ORIG	100 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	2000 U		200 U	200 U
	08/20/2002	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/19/2003	ORIG	15	24	8.1	1	3.4	1 U	2.3	1 U	1 U	10 U		1 U	1 U
	08/26/2003	ORIG	12	8.7	3.6	1 U	1 U	1 U	1	1 U	1 U	10 U		1 U	1 U
	02/24/2004	ORIG	8.8	11	4.4	0.71 J	1.1	0.26 J	2.3	1 U	1 U	10 U		0.33 J	1 U
	08/27/2004	ORIG	200 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U	4000 U		400 U	400 U
	08/27/2004	DUP	7	9.6	3.1	1 U	0.55 J	1 U	1.5	1 U	1 U	8.7 J		1 U	1 U
OW1b	110 - 120														
	07/02/1999	ORIG	0.5 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	10 U			1 U
	07/02/1999	N	0.5 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	10 U			1 U
	07/02/1999	DUP	0.5 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	10 U			1 U
	05/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	16		1 U	1 U
	05/16/2001	DUP	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/17/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	11/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/14/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/20/2002	ORIG	0.55	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/19/2003	ORIG	0.62	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/26/2003	ORIG	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/24/2004	ORIG	0.57	1.1	1 U	1.3	0.71 J	1 U	1 U	0.8 J	1 U	5 J		1 U	1 U
	08/27/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	6.1 J		1 U	1 U

Table 3-4
Omega Chemical Superfund Site
Aromatic and Other VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Benzene (1)	Toluene (150)	Ethyl benzene (300)	m,p- Xylenes (1750)	o- Xylene (1750)	sec-Butyl benzene (260#)	Isopropyl benzene (770#)	1,2,4-Trimethyl benzene (330#)	1,3,5-Trimethyl benzene (330#)	Acetone	2-Propanol	MTBE (13)	Naphthalene (17#)
OW2	60 - 80														
	07/02/1999	ORIG	2 U	2 U	4 U	4 U	4 U	2 U	4 U	4 U	4 U	40 U			4 U
	05/15/2001	ORIG	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U		10 U	10 U
	08/17/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	11/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/15/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/21/2002	ORIG	2 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		4 U	4 U
	02/19/2003	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	03/10/2003	ORIG	1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U		2 U	2 U
	08/27/2003	ORIG	2.5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	50 U		5 U	5 U
	02/24/2004	ORIG	2.5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	50 U		5 U	5 U
	08/24/2004	ORIG	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U		10 U	10 U
OW3	63 - 83														
	07/02/1999	ORIG	2 U	2 U	4 U	4 U	4 U	2 U	4 U	4 U	4 U	40 U			4 U
	05/16/2001	ORIG	10 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	200 U		20 U	20 U
	08/17/2001	ORIG	2 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		4 U	4 U
	11/15/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/15/2002	ORIG	2 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		4 U	4 U
	08/20/2002	ORIG	2 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		4 U	4 U
	02/20/2003	ORIG	2 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		4 U	4 U
	02/20/2003	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	03/13/2003	ORIG	2 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		4 U	4 U
	08/26/2003	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/25/2004	ORIG	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U		10 U	10 U
	02/25/2004	DUP	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U		10 U	10 U
	08/24/2004	ORIG	2.5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	50 U		5 U	5 U
OW4A	49.8 - 69.8														
	05/16/2001	ORIG	10 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	200 U		20 U	20 U
	08/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U

Table 3-4
Omega Chemical Superfund Site
Aromatic and Other VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Benzene (1)	Toluene (150)	Ethyl benzene (300)	m,p- Xylenes (1750)	o- Xylene (1750)	sec-Butyl benzene (260#)	Isopropyl benzene (770#)	1,2,4-Trimethyl benzene (330#)	1,3,5-Trimethyl benzene (330#)	Acetone	2-Propanol	MTBE (13)	Naphthalene (17#)
	11/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	11/16/2001	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/15/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/15/2002	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/21/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/20/2003	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	03/14/2003	ORIG	0.5 U	1.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/27/2003	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/27/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/25/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	12		0.5 J	0.52 J
	08/25/2004	DUP	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	9 J		0.39 J	1 U
OW4B	112 - 122.3														
	04/03/2001	ORIG	0.5 U	1 U	1 U	1.1	1 U	1 U	1 U	1 U	1 U	28	350		1 U
	05/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	120	940	1 U	1 U
	08/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	470		1 U	1 U
	11/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1500		1 U	1 U
	02/15/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	280	650	1 U	1 U
	08/21/2002	ORIG	1.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	240	570	1 U	1 U
	02/20/2003	ORIG	0.79	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	220		1 U	1 U
	08/27/2003	ORIG	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	46		1 U	1 U
	02/27/2004	ORIG	0.5 U	0.36 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	8.4 J		1 U	1 U
	08/25/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5.2 J		1 U	1 U
OW5	30 - 50														
	08/17/2001	ORIG	1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	20 U		2 U	2 U
	08/17/2001	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/17/2001	DUP	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	11/16/2001	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	11/16/2001	DUP	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/15/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U

Table 3-4
Omega Chemical Superfund Site
Aromatic and Other VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Benzene (1)	Toluene (150)	Ethyl benzene (300)	m,p- Xylenes (1750)	o- Xylene (1750)	sec-Butyl benzene (260#)	Isopropyl benzene (770#)	1,2,4-Trimethyl benzene (330#)	1,3,5-Trimethyl benzene (330#)	Acetone	2-Propanol	MTBE (13)	Naphthalene (17#)
OW6	02/15/2002	DUP	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/22/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/21/2003	ORIG	0.53	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/28/2003	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/24/2004	ORIG	0.89	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/25/2004	ORIG	0.81	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	14		0.51 J	1 U
	38 - 58														
	05/16/2001	ORIG	2.8	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		270	4 U
	08/17/2001	ORIG	2.5	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U		150	4 U
	11/16/2001	ORIG	1.7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		120	1 U
	02/15/2002	ORIG	2.4	1 U	1 U	1 U	1 U	1.4	1 U	1 U	1 U	10 U		92	1 U
	08/21/2002	ORIG	0.86	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		150	1 U
	02/21/2003	ORIG	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		34	1 U
	08/28/2003	ORIG	0.57	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		90	1 U
OW7	02/25/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1.4	1 U
	02/25/2004	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1.3
	08/25/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5.1 J		0.43 J	1 U
	70.9 - 90.9														
	03/27/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	03/27/2002	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/21/2002	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/21/2003	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/26/2003	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/25/2004	ORIG	0.5 U	0.39 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	6.6 J		1 U	1 U
OW8	08/25/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	60.4 - 80														
	03/27/2002	ORIG	5.4	1.9	1 U	1 U	0.62 J	1 U	1 U	1 U	1 U	41		1 U	1 U
	08/22/2002	ORIG	10 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	200 U		20 U	20 U
	08/22/2002	DUP	5.3	4.7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	89		1 U	1 U

Table 3-4
Omega Chemical Superfund Site
Aromatic and Other VOCs Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Benzene (1)	Toluene (150)	Ethyl benzene (300)	m,p- Xylenes (1750)	o- Xylene (1750)	sec-Butyl benzene (260#)	Isopropyl benzene (770#)	1,2,4-Trimethyl benzene (330#)	1,3,5-Trimethyl benzene (330#)	Acetone	2-Propanol	MTBE (13)	Naphthalene (17#)
	02/20/2003	ORIG	10 U	44	20 U	20 U	20 U	20 U	20 U	20 U	20 U	1600		20 U	20 U
	02/20/2003	DUP	12 U	120	25 U	25 U	25 U	25 U	25 U	25 U	25 U	5800		25 U	25 U
	03/11/2003	ORIG	50 U	900	100 U	100 U	100 U	100 U	100 U	100 U	100 U	6300		100 U	100 U
	03/11/2003	DUP	50 U	860	100 U	100 U	100 U	100 U	100 U	100 U	100 U	5800		100 U	100 U
	08/27/2003	ORIG	12 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	250 U		25 U	25 U
	08/27/2003	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	08/27/2003	DUP	20 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	400 U		40 U	40 U
	11/20/2003	ORIG	7.2	410	13	44	26	1 U	1.2	11	2.4	2500		1 U	1 U
	02/24/2004	ORIG	25 U	92	50 U	50 U	50 U	50 U	50 U	50 U	50 U	2000		50 U	50 U
	08/24/2004	ORIG	50 U	340	100 U	100 U	27 J	100 U	100 U	100 U	100 U	7400		100 U	100 U
	08/24/2004	N	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	7.2 J		1 U	1 U
OW8B	116 - 126														
	08/24/2004	ORIG	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5.7 J		1 U	1 U
QC	-														
	08/21/2002	M	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/19/2003	M	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/20/2003	M	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U
	02/21/2003	M	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U		1 U	1 U

Notes:

Concentrations are reported in micrograms per liter (ug/l)

Screened interval is shown in feet below ground surface.

Only analytes detected above laboratory reporting limits in one or more groundwater samples are listed.

U = Not detected at a concentration greater than the reporting limit shown

H = Estimated result; sample analyzed after holding time

J = Estimated concentration between the laboratory method detection and reporting limits.

Samples analyzed by EPA Methods 502.2, 8240 or 8260.

If blank, analyte was either not reported or not analyzed

MTBE = Methyl tertiary butyl ether

Sample Type:

DUP = Duplicate sample

ORIG = Original sample

M = Trip Blank

N = Equipment decontamination blank

California Maximum Contaminant Levels (MCLs) are shown in parenthesis

= California Action Level

Table 3-7
Omega Chemical Superfund Site
Cyanide, Hexavalent Chromium, Perchlorate and 1,4-Dioxane Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Cyanide (150)	Hexavalent Chromium (50*)	Perchlorate (6#)	1,4-Dioxane (3#)
OW1 62.5 - 77.5	05/16/2001	ORIG	25 U		4 U	
	08/17/2001	ORIG	25 U		4 U	
	11/15/2001	ORIG			4 U	3300 E
	02/14/2002	ORIG	25 U		4 U	11000 E
	08/20/2002	ORIG				4100 E
	08/20/2002	N				0.63
	02/19/2003	ORIG		0.3 U	4 U	52000
	08/26/2003	ORIG				8400
	08/26/2003	DUP				2700 E
	02/24/2004	ORIG				12000
	08/27/2004	ORIG				5600
	08/27/2004	DUP				6800
OW1b 110 - 120	05/16/2001	ORIG	25 U		4 U	
	05/16/2001	DUP	25 U		4 U	
	08/17/2001	ORIG	25 U		4 U	
	11/16/2001	ORIG			4 U	57
	02/14/2002	ORIG	25 U		4 U	41
	08/20/2002	ORIG				60
	02/19/2003	ORIG		0.3 U	4 U	17
	08/26/2003	ORIG				27
	02/24/2004	ORIG				26
	08/27/2004	ORIG				14
OW2 60 - 80	11/16/2001	ORIG				0.5 U
	02/15/2002	ORIG				0.54 U
	08/21/2002	ORIG				1
	02/19/2003	ORIG		3.1	4 U	1.4
	03/10/2003	ORIG				0.5 U
	08/27/2003	ORIG				0.5 U
	02/24/2004	ORIG				0.5 U
	08/24/2004	ORIG				12
OW3 63 - 83	11/15/2001	ORIG				1
	02/15/2002	ORIG				1.1
	08/20/2002	ORIG				1.2
	02/20/2003	ORIG		5.4	4 U	0.5 U
	02/20/2003	N		0.3 U	4 U	0.5 U
	03/13/2003	ORIG				1.2
	08/26/2003	ORIG				1.6 UB
	02/25/2004	ORIG				0.51
	02/25/2004	DUP				0.5 U
	08/24/2004	ORIG				0.5 U

Table 3-7
Omega Chemical Superfund Site
Cyanide, Hexavalent Chromium, Perchlorate and 1,4-Dioxane Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Cyanide (150)	Hexavalent Chromium (50*)	Perchlorate (6#)	1,4-Dioxane (3#)
OW4A 49.8 - 69.8	11/16/2001	ORIG				4.9
	02/15/2002	ORIG				11
	08/21/2002	ORIG				14
	02/20/2003	ORIG		12	4 U	0.88
	03/14/2003	ORIG				1.8
	08/27/2003	ORIG				1 UB
	02/27/2004	ORIG				0.5 U
	08/25/2004	ORIG				1.8
	08/25/2004	DUP				1.9
OW4B 112 - 122.3	11/16/2001	ORIG				0.53 U
	02/15/2002	ORIG				0.51 U
	08/21/2002	ORIG				0.5 U
	02/20/2003	ORIG		0.3 U	9.4	0.5 U
	08/27/2003	ORIG				0.6 UB
	02/27/2004	ORIG				0.5 U
	08/25/2004	ORIG				0.5 U
OW5 30 - 50	11/16/2001	ORIG				0.76
	11/16/2001	DUP				0.88
	02/15/2002	ORIG				1.1
	02/15/2002	DUP				0.98
	08/28/2003	ORIG				0.58
	02/24/2004	ORIG				68
	08/25/2004	ORIG				85
OW6 38 - 58	11/16/2001	ORIG				4
	02/15/2002	ORIG				0.86
	08/28/2003	ORIG				0.85
	02/25/2004	ORIG				0.7
	02/25/2004	N				0.5 U
	08/25/2004	ORIG				0.5 U
OW7 70.9 - 90.9	03/27/2002	ORIG				0.5 U
	08/26/2003	ORIG				0.5 U
	02/25/2004	ORIG				0.5 U
	08/25/2004	ORIG				0.5 U
OW8 60.4 - 80	03/27/2002	ORIG				1000
	08/22/2002	ORIG				830
	08/22/2002	DUP				840
	02/20/2003	ORIG		1.1	4 U	240
	02/20/2003	DUP		0.86	4 U	180
	03/11/2003	ORIG				2600

Table 3-7
Omega Chemical Superfund Site
Cyanide, Hexavalent Chromium, Perchlorate and 1,4-Dioxane Analytical Summary
Groundwater Analytical Results

Well ID/ Screened Interval	Sample Date	Sample Type	Cyanide (150)	Hexavalent Chromium (50*)	Perchlorate (6#)	1,4-Dioxane (3#)
OW8 60 4 - 80	03/11/2003	DUP				2600
	08/27/2003	ORIG				98
	08/27/2003	N				0.5 UB
	08/27/2003	DUP				89
	11/20/2003	ORIG				2700
	02/24/2004	ORIG				210
	08/24/2004	ORIG				5300
	08/24/2004	N				0.5 U
OW8B 116 - 126	08/24/2004	ORIG				0.5 U

Notes

Concentrations are reported in micrograms per liter (ug/l)

U = Not detected at a concentration greater than the reporting limit shown

E = Estimated result Concentration exceeds instrument's upper calibration range

B = Analyte also detected in laboratory method blank

Screened interval is shown in feet below ground surface

Cyanide analyzed by EPA Method 335.2, perchlorate by EPA Method 300 modified or Method 314 (2003 results), 1,4-dioxane analyzed by EPA Method 8270 modified, and hexavalent chromium analyzed by EPA Method 218.6

Sample Type

DUP = Duplicate sample

ORIG = Original sample

N = Equipment decontamination blank

California Maximum Contaminant Levels (MCLs) are shown in parenthesis

= California Action Level

* = Total chromium MCL

Table 3-10 Summary of Aquifer Test Results

Tested Well	Test Date	Test Type	Observation Well	Discharge Rate (gpm)	Duration (Hours)	Analysis Method	Transmissivity (ft ² /day)	Comments
OW2	March, 2003	Single borehole recovery	NA	2.3	4	Cooper-Jacob Recovery	170	
OW3	March, 2003	Single borehole recovery	NA	1.34	4		NA	
OW4a	March, 2003	Single borehole recovery	NA	10.3	4	Cooper-Jacob Recovery	2691	Likely impacted by delayed yield
OW8	March, 2003	Single borehole recovery	NA	10.4	4	Cooper-Jacob Recovery	1616	Likely impacted by delayed yield
OW8	November, 2003	Multi-well test	NA	10.96	19.7	Cooper-Jacob Recovery	614	
	November, 2003	Multi-well test	PZ-1	10.96	19.7	Neuman	563	Specific yield 0.09
	November, 2003	Multi-well test	PZ-2	10.96	19.7	Neuman	810	Specific yield 0.20

DATA VALIDATION REPORT

CLP-LIKE DATA PACKAGE

Project: Omega Chemical Superfund Site
Groundwater Monitoring Well Sampling – February 2004

References: USEPA CLP National Functional Guidelines for Organic Data
Review October 1999 (EPA540/R-99/008)

SW-846 Method 8000B, December 1996
SW-846 Method 8260B, December 1996
SW-846 Method 8270C, December 1996

Reviewer: Barbara Wells
CDM - Carlsbad, California

Date: December 2004

Analytical Laboratory: Del Mar Analytical (Del Mar)
Irvine, California 92614

DATA REVIEW

Five water samples (listed below) were collected on February 25, 2004, and transported to Del Mar Analytical. All samples were collected from groundwater monitoring wells and analyzed for the following: volatile organic compounds (VOCs) by EPA Method 8260B and 1,4-dioxane by EPA Method 8270 (modified). Sample identification and collection dates are summarized in the following table.

Sample Summary Table

<i>Sample ID</i>	<i>Lab Sample ID</i>	<i>Sample Type¹</i>	<i>Date Collected</i>
OC-GW-OW3-022504	INB1636-01	GW	2/25/04
OC-GW-OW9-022504	INB1636-02	DUP	2/25/04
OC-GW-OW7-022504	INB1636-03	GW	2/25/04
OC-GW-OW6-022504	INB1636-04	GW	2/25/04
OC-GW-OW10-022504	INB1636-05	N	2/25/04

Notes:

¹ GW DUP N	= = =	Groundwater sample Split (duplicate) groundwater sample Equipment decontamination blank
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VOLATILE ORGANIC COMPOUNDS ASSESSMENT - METHOD 8260B

I. TECHNICAL HOLDING TIMES

All technical holding times requirements were met. Water samples were analyzed between March 2 and 6, 2004, which is within the 14-day holding time criteria.

II. INITIAL CALIBRATION

Initial calibration of the instrument must be performed using a minimum of five standard concentrations. For initial calibration to be accepted, five system performance check compounds (SPCCs) must meet the following minimum average response factors (RFs):

Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

SPCCs are used to check compound instability and to check for degradation caused by contaminated lines or active sites in the system. The average RF for each of the five SPCCs met the minimum calibration criteria listed above.

Additionally, the relative standard deviation (RSD) of the response factors of the initial calibration curve should be less than or equal to 15 percent for all target analytes and less than or equal to 30 percent for six calibration check compounds (CCCs). The six CCCs are: 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene, ethylbenzene and vinyl chloride. If the RSD of the target analytes is 15 percent or less and less than 30 percent for the six CCCs, then the RF is assumed to be constant over the calibration range and the average RF can be used for quantitation.

If the RSD of the target analytes exceeds the 15 percent criterion, other calibration options can be employed. As discussed in Section 7.0 of Method 8000, linear calibration using a least squares regression may be used with the initial calibration data to demonstrate the instrument calibration linearity. Least squares regression was used for the target analytes listed above, which did not have an average RF of 15 percent or less. For initial calibration to be accepted using a least squares model, the coefficient of determination must be greater than or equal to 0.99.

Initial calibration of GC/MS #1 was performed on February 26, 2004 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #1 was used to analyze all samples included in this group, except for the re-analysis (at a 20x dilution) of PCE in the sample collected from OW3. All target analytes and CCCs met the 15 percent calibration criteria except for acetone, dibromochloromethane, chlorobenzene, bromoform, and 1,2-dibromo-3-chloropropane. The coefficient of

determination exceeded 0.99 for these five compounds. All criteria for initial calibration were met for all compounds and no qualification is necessary.

Initial calibration of GC/MS #34 was performed on February 29, 2004 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #34 was used to re-analyze sample OW3 for PCE (dilution factor of 10) on March 6, 2004. All target analytes and CCCs met the 15 percent calibration criteria for GC/MS #34 except for bromoform, 1,2-dibromo-3-chloropropane, 1,2,4-trichlorobenzene, naphthalene, and 1,2,3-trichlorobenzene. The coefficient of determination exceeded 0.99 for these five compounds. All criteria for initial calibration of GC/MS #34 were met for all compounds and no qualification is necessary.

III. CONTINUING CALIBRATION

The initial GC/MS calibration is verified once every 12 hours by analyzing a 4-bromofluorobenzene tuning standard and a calibration verification standard (a midpoint check standard) and prior to analyzing any samples. The calibration verification standard must contain each of the five SPCCs used during initial calibration. The minimum RF for each SPCC must meet the criteria specified for initial calibration (i.e., 0.10 to 0.30). In addition, initial calibration is checked using the CCCs used during initial calibration. If the percent difference (%D) of each of the CCCs is less than 20 percent, the initial calibration is assumed to be valid.

Samples were analyzed on March 2, 3, 4 (GC/MS #1) and 6 (GC/MS #34), 2004. Prior to sample analysis, a 50 ng BFB tuning standard was analyzed. Mass ion abundance criteria were met for the system. Each of the five SPCCs and the six CCCs were contained in a mid-point check standard at concentrations of 25 ppb. The RF for each of the SPCCs was greater than the criteria specified and the %D between the continuing calibration and the initial calibration for each of the CCCs was less than 20 percent for each batch of samples. Therefore, the initial calibrations were validated and continuing calibration criteria were met.

IV. METHOD BLANKS

A method blank must be analyzed with each batch of samples for each matrix type immediately after initial calibration is verified and before sample analysis. A total of four method blanks were reported, which correspond to the four analysis dates. No target analytes were detected at concentrations above their respective reporting limits in the blanks analyzed on March 2, 3, 4 and 6, 2004. Therefore, all criteria were met and no further action is required.

V. SURROGATES

Three surrogate spikes (dibromofluoromethane, toluene-d8 and 4-bromofluorobenzene) were added to each environmental sample, QC sample, and method blank, as required by the method. Surrogate control limits were established by the laboratory and are 80 to 120 percent for all three surrogates.

All surrogate recoveries were within the acceptable control limits.

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Four MS and MSD sample sets were analyzed with this group of samples. Acceptance limits for MS and MSD recoveries and the relative percent difference (RPD) between the MS and the MSD were statistically determined by the laboratory and were provided with the laboratory report for each analyte.

Except for the analytes presented on the following table, the percent recoveries for the MS and MSD samples were within the acceptance criteria for all spiked compounds.

Analyte	QC Sample Type	Analysis Date	Recovery (%)	Acceptance Limits (%)
Styrene	MS	3/2/04	59	60 - 145
Carbon tetrachloride	MS	3/3/04	146	70 - 140
Bromodichloromethane	MSD	3/3/04	137	50 - 135
Carbon tetrachloride	MSD	3/3/04	145	70 - 140
1,2-Dibromoethane	MSD	3/3/04	138	70 - 125
Styrene	MSD	3/3/04	53	60 - 145
1,2-Dibromoethane	MSD	3/4/04	128	70 - 125

As shown on the preceding table all the out-of-range MS and/or MSD recoveries were above the upper control limits except for styrene. In each of these cases of elevated recoveries, the analyte was not detected in the associated project samples. Therefore, the high MS and/or MSD recoveries did not impact the results and has no affect on the usability of the data. With respect to styrene, the MS and/or MSD recoveries for the samples analyzed on March 2 and 3, 2004, were just slightly below the lower control limit of 60 percent. Because the corresponding LCS recoveries were within acceptable limits, qualification of the data was not warranted. Therefore, no further action is required.

The relative percent difference (RPD) between the MS and MSD samples were within acceptable criteria for all compounds in the four analytical batches except for 1,2-dibromo-3-chloropropane (analyzed on March 3, 2004). Because this compound was not detected in the associated samples, the slightly poor precision does not affect the project data. Therefore, qualification is not warranted.

VII. LABORATORY CONTROL SAMPLES (LCS)

Four LCS samples were analyzed with each batch of samples, which meets the analytical method requirement of one LCS per analytical batch. Results from the LCS sample were included in the analytical report. All LCS analyte recoveries were within the acceptance limits established by the laboratory, which demonstrates acceptable accuracy.

VIII. REGIONAL QUALITY ASSURANCE AND QUALITY CONTROL

Sample OC-GW-OW9-022504 was submitted as a duplicate of sample OC-GW-OW3-022504. The RPDs between detected analyte concentrations were less than 25 percent for all compounds, which demonstrates acceptable precision.

Also, sample OC-GW-OW10-022504, an equipment blank, was submitted for analysis. Tetrachloroethene (PCE) and naphthalene were detected in the field blank at concentrations of 1.4 and 1.3 ug/L, respectively. PCE concentrations detected in all associated samples were greater than 10 times the blank concentration. Therefore, the PCE concentration in the equipment blank was insignificant relative to all other sample concentrations. Naphthalene was not detected in any of the associated project samples so the equipment blank contamination had no impact on the project data. Overall, all field QC criteria were met.

IX. INTERNAL STANDARDS

Internal standard (IS) area counts and retention times for samples analyzed on March 2 through 6, 2004 were within validation criteria. IS area counts for all samples analyzed were within -50 - +100 percent of the IS area count from the daily calibration standard. IS retention times were within ± 30 seconds from the retention time of the associated daily standard.

X. TARGET COMPOUND IDENTIFICATION

All positive compound identifications were confirmed through the mass spectra library.

XI. COMPOUND QUANTITATION

Several positive results were recalculated to ensure that compound quantitation was accurate. No errors were encountered. Compound quantitation was based on the initial calibration average RF.

XII. SYSTEM PERFORMANCE

The system performance was acceptable.

XIII. OVERALL ASSESSMENT OF VOC DATA

All QC criteria evaluated during data validation of the VOC analyses were within acceptable limits. No QC issues were encountered that were significant enough to require qualification of the data. Therefore, all VOC data can be used as reported and meet the project objectives.

1,4-DIOXANE DATA ASSESSMENT

Five samples were analyzed for low-level 1,4-dioxane. Because there is no analytical method promulgated by EPA for the analysis of low-level 1,4-dioxane, Del Mar followed a modified EPA Method 8270C method, using isotopic dilution with GC/MS. Method 8270C QC criteria were used during this review to assess data for general compliance. Data reviewed for the 1,4-dioxane analyses include: holding times, instrument calibration, blank results, LCS recoveries, and MS/MSD recoveries and precision.

I. TECHNICAL HOLDING TIMES

According to Method 8270C, the holding time for 1,4-dioxane in water is 7 days from sample collection until extraction; and 40 days from extraction to analysis. The five samples were extracted on February 25, 2004, which is less than one day from sample collection, and analyzed on February 27, 2004. Therefore, all holding times were met.

II. INITIAL CALIBRATION

Initial calibration of GC/MS #5 was performed on November 22, 2003, using seven standard concentrations ranging from 0.2 to 10 ug/L, which meet the 8270C requirement of initial calibration using five concentration levels. The percent relative standard deviation (%RSD) of the response factors over the entire calibration curve was 6.9 percent, which meets general criteria (specified in Method 8000) of less than 15 percent. Therefore, the calibration curve was considered linear.

III. CONTINUING CALIBRATION

The initial calibration of GC/MS #5 was verified prior to sample analysis by analyzing 2 ug/L standard (mid point of the curve). The difference between the continuing calibration verification standard and the initial value was 12 percent, which demonstrates that the initial calibration was valid.

IV. METHOD BLANKS

A method blank was analyzed with this batch of samples to verify that the instrument is free from contamination. 1,4-Dioxane was not detected at a concentration above the reporting limit of 0.5 ug/L in the method blank. Therefore, no further action is required.

V. LABORATORY CONTROL SAMPLES (LCS)

One LCS sample was analyzed with this batch of samples, which meets Method 8270C criteria. Results from the LCS sample were included in the analytical report. The LCS recovery for 1,4-dioxane in the batch of samples was 60 percent, which is within the acceptable range of 35 to 120 percent (established by Del Mar). Therefore, acceptable accuracy was demonstrated and no further action is required.

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES

One MS and MSD sample set was analyzed with the batch of samples analyzed on February 27, 2004. Acceptance limits for MS and MSD recoveries were determined by the laboratory to be 35 to 120 percent. The percent recoveries for the MS and MSD samples were within the acceptance criteria, which suggest that significant interferences from the sample matrix did not occur. Therefore, all criteria were met. Furthermore, the RPD between the MS and MSD recoveries was 1 percent, which demonstrates acceptable precision.

VII. REGIONAL QUALITY ASSURANCE AND QUALITY CONTROL

Sample OC-GW-OW9-022504 was submitted as a duplicate of sample OC-GW-OW3-022504. 1,4-Dioxane was detected in the primary sample at a concentration of 0.51 ug/L, which is just slightly higher than the reporting limit of 0.50 ug/L. 1,4-Dioxane was not detected in the duplicate sample. Because the concentration reported in the primary sample was less than five times the reporting limit, the difference in duplicate sample concentrations is not significant and qualification is not warranted.

Also, sample OC-GW-OW10-022504, an equipment blank, was submitted for analysis. 1,4-Dioxane was not detected in the blank. Therefore, all field QC criteria were met.

VIII. INTERNAL STANDARDS

Internal standard (IS) area counts and retention times for samples analyzed on February 27, 2004 were within validation criteria. IS area counts for all samples analyzed were within -50 - +100 percent of the IS area count from the daily calibration standard. IS retention times were within ± 30 seconds from the retention time of the associated daily standard.

IX. TARGET COMPOUND IDENTIFICATION

All positive compound identifications were confirmed through the mass spectra library.

X. COMPOUND QUANTITATION

Two positive results were recalculated to ensure that compound quantitation was accurate. No errors were encountered. Compound quantitation was based on the initial calibration average RF.

XI. SYSTEM PERFORMANCE

The system performance was acceptable.

XII. OVERALL ASSESSMENT OF 1,4-DIOXANE DATA

Although no EPA method exists for the analysis of low-level 1,4-dioxane, the project data were reviewed for general compliance with standard QC criteria requirements specified for organic analyses. Also, QC sample results were evaluated against laboratory specified acceptance criteria for method compliance. No significant QC issues were encountered during the data review. Therefore, the 1,4-dioxane data can be used for the project purposes without qualification.

DATA VALIDATION REPORT

CLP-LIKE DATA PACKAGE

Project: Omega Chemical Superfund Site
Groundwater Monitoring Well Sampling – August 2003

References: USEPA CLP National Functional Guidelines for Organic Data
Review October 1999 (EPA540/R-99/008)

SW-846 Method 8000B, December 1996
SW-846 Method 8260B, December 1996
SW-846 Method 8270C, December 1996

Reviewer: Barbara Wells
CDM - Carlsbad, California

Date: December 2004

Analytical Laboratory: Del Mar Analytical (Del Mar)
Irvine, California 92614

DATA REVIEW

Four water samples (listed below) were collected on August 26, 2003, and transported to Del Mar Analytical. All samples were collected from groundwater monitoring wells and were analyzed for the following: volatile organic compounds (VOCs) by EPA Method 8260B and 1,4-dioxane by EPA Method 8270 (modified). Sample identification and collection dates are summarized in the following table.

Sample Summary Table

<i>Sample ID</i>	<i>Lab Sample ID</i>	<i>Sample Type¹</i>	<i>Date Collected</i>
OC-GW-OW3-082603	IMH1415-01	GW	8/26/03
OC-GW-OW1-082603	IMH1415-02	GW	8/26/03
OC-GW-OW1b-082603	IMH1415-03	GW	8/26/03
OC-GW-OW7-082603	IMH1415-04	GW	8/26/03

Notes:

¹ GW = Groundwater sample

VOLATILE ORGANIC COMPOUNDS ASSESSMENT - METHOD 8260B

I. TECHNICAL HOLDING TIMES

All technical holding times requirements were met. Water samples were analyzed between September 2 and 4, 2003, which is within the 14-day holding time criteria.

II. INITIAL CALIBRATION

Initial calibration of the instrument must be performed using a minimum of five standard concentrations. For initial calibration to be accepted, five system performance check compounds (SPCCs) must meet the following minimum average response factors (RFs):

Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

SPCCs are used to check compound instability and to check for degradation caused by contaminated lines or active sites in the system. The average RF for each of the five SPCCs met the minimum calibration criteria listed above.

Additionally, the relative standard deviation (RSD) of the response factors of the initial calibration curve should be less than or equal to 15 percent for all target analytes and less than or equal to 30 percent for six calibration check compounds (CCCs). The six CCCs are: 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene, ethylbenzene and vinyl chloride. If the RSD of the target analytes is 15 percent or less and less than 30 percent for the six CCCs, then the RF is assumed to be constant over the calibration range and the average RF can be used for quantitation.

If the RSD of the target analytes exceeds the 15 percent criterion, other calibration options can be employed. As discussed in Section 7.0 of Method 8000, linear calibration using a least squares regression may be used with the initial calibration data to demonstrate the instrument calibration linearity. Least squares regression was used for the target analytes listed above, which did not have an average RF of 15 percent or less. For initial calibration to be accepted using a least squares model, the coefficient of determination must be greater than or equal to 0.99.

Initial calibration of GC/MS #32 was performed on August 5, 2003 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #32 was used to analyze samples collected from wells OW3 and OW1 on September 2, 2003. All target analytes and CCCs met the 15 percent calibration criteria except for bromochloromethane, bromoform and 1,2-dibromo-3-chloropropane. The coefficient

of determination exceeded 0.99 for these compounds. All criteria for initial calibration were met for all compounds and no qualification is necessary.

Initial calibration of GC/MS #1 was performed on August 5, 2003 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #1 was used to analyze samples collected from OW1b and OW7 and to re-analyze samples collected from OW3 and OW1 at higher dilutions (20 and 50 times, respectively) on September 3, 2003. Ten target analytes exceeded the 15 percent calibration criteria for GC/MS #1 but had coefficients of determination that exceeded 0.99. Therefore, all criteria for initial calibration of GC/MS #q were met for all compounds and no qualification is necessary.

Initial calibration of GC/MS #9 was performed on August 25, 2003 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #9 was used to re-analyze sample OW1 on September 4, 2003 at a dilution factor of 1000. All target analytes and CCCs met the 15 percent calibration criteria for GC/MS #9 except for bromoform, dibromochloromethane and 1,2-dibromo-3-chloropropane. The coefficient of determination exceeded 0.99 for these compounds. All criteria for initial calibration of GC/MS #9 were met for all compounds and no qualification is necessary.

III. CONTINUING CALIBRATION

The initial GC/MS calibration is verified once every 12 hours by analyzing a 4-bromofluorobenzene tuning standard and a calibration verification standard (a midpoint check standard) and prior to analyzing any samples. The calibration verification standard must contain each of the five SPCCs used during initial calibration. The minimum RF for each SPCC must meet the criteria specified for initial calibration (i.e., 0.10 to 0.30). In addition, initial calibration is checked using the CCCs used during initial calibration. If the percent difference (%D) of each of the CCCs is less than 20 percent, the initial calibration is assumed to be valid.

Samples were analyzed on September 2 (GC/MS #32), 3 (GC/MS #1) and 4 (GC/MS #9), 2004. Prior to sample analysis, a 50 ng BFB tuning standard was analyzed. Mass ion abundance criteria were met for the system. Each of the five SPCCs and the six CCCs were contained in a mid-point check standard at concentrations of 25 ppb. The RF for each of the SPCCs was greater than the criteria specified and the %D between the continuing calibration and the initial calibration for each of the CCCs was less than 20 percent for each batch of samples. Therefore, the initial calibrations were validated and continuing calibration criteria were met.

IV. METHOD BLANKS

A method blank must be analyzed with each batch of samples for each matrix type immediately after initial calibration is verified and before sample analysis. A total of three method blanks were reported, which correspond to the three analytical batches.

No target analytes were detected at concentrations above their respective reporting limits in the blanks analyzed on September 2, 3 and 4, 2003.

V. SURROGATES

Three surrogate spikes (dibromofluoromethane, toluene-d8 and 4-bromofluorobenzene) were added to each environmental sample, QC sample, and method blank, as required by the method. Surrogate control limits were established by the laboratory and are 80 to 120 percent for all three surrogates.

All surrogate recoveries were within the acceptable control limits.

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Three MS and MSD sample sets were analyzed with this group of samples. Acceptance limits for MS and MSD recoveries and the relative percent difference (RPD) between the MS and the MSD were statistically determined by the laboratory and were provided with the laboratory report for each analyte.

Except for naphthalene and TCE in one batch of samples, the percent recoveries for all other MS and MSD samples were within the acceptance criteria for all spiked compounds. Naphthalene was reported in the MSD analyzed on September 3, 2003 at 49 percent, which is slightly below the lower control limit of 50 percent; and TCE was reported in the same MSD at 69 percent, which is slightly below the lower control limit of 70 percent. Because the corresponding MS and LCS recoveries were both within acceptable limits, qualification of the data was not warranted. Therefore, no further action was required.

The relative percent difference (RPD) between the MS and MSD samples were within acceptable criteria for all compounds in each of the analytical batches. Therefore, acceptable precision was demonstrated.

VII. LABORATORY CONTROL SAMPLES (LCS)

Three LCS samples were analyzed, which meets the analytical method requirement of one LCS per analytical batch. Results from the LCS sample were included in the analytical report. All LCS analyte recoveries were within the acceptance limits established by the laboratory, which demonstrates acceptable accuracy.

VIII. REGIONAL QUALITY ASSURANCE AND QUALITY CONTROL

No duplicates or field blanks were submitted with this group of samples.

IX. INTERNAL STANDARDS

Internal standard (IS) area counts and retention times for samples analyzed on September 2 through 4, 2003 were within validation criteria. IS area counts for all samples analyzed were within -50 - +100 percent of the IS area count from the daily calibration standard. IS retention times were within ± 30 seconds from the retention time of the associated daily standard.

X. TARGET COMPOUND IDENTIFICATION

All positive compound identifications were confirmed through the mass spectra library.

XI. COMPOUND QUANTITATION

Several positive results were recalculated to ensure that compound quantitation was accurate. No errors were encountered. Compound quantitation was based on the initial calibration average RF.

XII. SYSTEM PERFORMANCE

The system performance was acceptable.

XIII. OVERALL ASSESSMENT OF VOC DATA

All QC criteria evaluated during data validation of the VOC analyses were within acceptable limits. No QC issues were encountered that were significant enough to reject or qualify the data. Therefore, all VOC data can be used as reported and meet the project objectives.

1,4-DIOXANE DATA ASSESSMENT

Four samples were analyzed for low-level 1,4-dioxane. Because there is no analytical method promulgated by EPA for the analysis of low-level 1,4-dioxane, Del Mar followed a modified EPA Method 8270C method, using isotopic dilution with GC/MS. Method 8270C QC criteria were used during this review to assess data for general compliance. Data reviewed for the 1,4-dioxane analyses include: holding times, instrument calibration, blank results, LCS recoveries, and MS/MSD recoveries and precision.

I. TECHNICAL HOLDING TIMES

According to Method 8270C, the holding time for 1,4-dioxane in water is 7 days from sample collection until extraction; and 40 days from extraction to analysis. The samples were extracted on August 28, 2003, which is two days from sample collection, and analyzed on September 3 and 4, 2003. Therefore, all holding times were met.

II. INITIAL CALIBRATION

Initial calibration of GC/MS #5 was performed on July 24, 2003, using seven standard concentrations ranging from 0.2 to 10 ug/L, which meet the 8270C requirement of initial calibration using five concentration levels. The percent relative standard deviation (%RSD) of the response factors over the entire calibration curve was 8.7 percent, which meets general criteria (specified in Method 8000) of less than 15 percent. Therefore, the calibration curve was considered linear.

III. CONTINUING CALIBRATION

The initial calibration of GC/MS #5 was verified prior to sample analysis by analyzing a 2 ug/L standard (mid point of the curve). The difference between the continuing calibration verification standard and the initial value was 8.9 percent on September 3 and 5.6 percent on September 4, 2003, which demonstrate that the initial calibrations were valid.

IV. METHOD BLANKS

Method blanks were analyzed with the two batches of samples to verify that the instrument is free from contamination. 1,4-Dioxane was detected at a concentration of 0.965 ug/l in the blank analyzed on September 3, 2003, which is above the reporting limit of 0.5 ug/L. One sample, collected from well OW3, contained 1,4-dioxane at a concentration of 1.6 ug/l, which is less than 5 times the blank concentration. As a result, this result was qualified with a "UB" to indicate a non-detectable concentration due to method blank contamination. All other samples contained 1,4-dioxane at levels greater than five times the blank concentration.

V. LABORATORY CONTROL SAMPLES (LCS)

One LCS sample was analyzed with this batch of samples, which meets Method 8270C criteria. Results from the LCS sample were included in the analytical report. The LCS recovery for 1,4-dioxane in the batch of samples was 86 percent, which is

within the acceptable range of 35 to 120 percent (established by Del Mar). Therefore, acceptable accuracy was demonstrated and no further action is required.

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES

MS and MSD recoveries were not reported with this batch of samples. Acceptable accuracy was demonstrated by the successful analysis of the LCS.

VII. REGIONAL QUALITY ASSURANCE AND QUALITY CONTROL

No duplicates or field blanks were submitted with this group of samples.

VIII. INTERNAL STANDARDS

Internal standard (IS) area counts and retention times for samples analyzed on September 3 and 4, 2003 were within validation criteria. IS area counts for all samples analyzed were within -50 - +100 percent of the IS area count from the daily calibration standard. IS retention times were within ± 30 seconds from the retention time of the associated daily standard.

IX. TARGET COMPOUND IDENTIFICATION

All positive compound identifications were confirmed through the mass spectra library.

X. COMPOUND QUANTITATION

Positive results were recalculated to ensure that compound quantitation was accurate. No errors were encountered. Compound quantitation was based on the initial calibration average RF.

XI. SYSTEM PERFORMANCE

The system performance was acceptable.

XII. OVERALL ASSESSMENT OF 1,4-DIOXANE DATA

Although no EPA method exists for the analysis of low-level 1,4-dioxane, the project data were reviewed for general compliance with standard QC criteria requirements specified for organic analyses. Also, QC sample results were evaluated against laboratory specified acceptance criteria for method compliance. No significant QC issues were encountered during the data review. Except for one result, the 1,4-dioxane data can be used for the project purposes without qualification. Due to method blank contamination, the concentration reported in OW3 was qualified as non-detectable.

DATA VALIDATION REPORT

CLP-LIKE DATA PACKAGE

Project: Omega Chemical Superfund Site
Groundwater Monitoring Well Sampling – August 2004

References: USEPA CLP National Functional Guidelines for Organic Data
Review October 1999 (EPA540/R-99/008)

SW-846 Method 8000B, December 1996
SW-846 Method 8260B, December 1996
SW-846 Method 8270C, December 1996

Reviewer: Barbara Wells
CDM - Carlsbad, California

Date: December 2004

Analytical Laboratory: Del Mar Analytical (Del Mar)
Irvine, California 92614

DATA REVIEW

Three water samples (listed below) were collected on August 27, 2004, and transported to Del Mar Analytical. All samples were collected from groundwater monitoring wells and were analyzed for the following: volatile organic compounds (VOCs) by EPA Method 8260B and 1,4-dioxane by EPA Method 8270 (modified). Sample identification and collection dates are summarized in the following table.

Sample Summary Table

<i>Sample ID</i>	<i>Lab Sample ID</i>	<i>Sample Type</i> ¹	<i>Date Collected</i>
OC-GW-OW1b-082704	INH1702-01	GW	8/27/04
OC-GW-OW1-082704	INH1702-02	GW	8/27/04
OC-GW-OW1k-082704	INH1702-03	K	8/27/04

Notes:

¹ GW = Groundwater sample
K = Split (duplicate) groundwater sample

VOLATILE ORGANIC COMPOUNDS ASSESSMENT - METHOD 8260B

I. TECHNICAL HOLDING TIMES

All technical holding times requirements were met. Water samples were analyzed between September 8 and 10, 2004, which is within the 14-day holding time criteria.

II. INITIAL CALIBRATION

Initial calibration of the instrument must be performed using a minimum of five standard concentrations. For initial calibration to be accepted, five system performance check compounds (SPCCs) must meet the following minimum average response factors (RFs):

Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

SPCCs are used to check compound instability and to check for degradation caused by contaminated lines or active sites in the system. The average RF for each of the five SPCCs met the minimum calibration criteria listed above.

Additionally, the relative standard deviation (RSD) of the response factors of the initial calibration curve should be less than or equal to 15 percent for all target analytes and less than or equal to 30 percent for six calibration check compounds (CCCs). The six CCCs are: 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene, ethylbenzene and vinyl chloride. If the RSD of the target analytes is 15 percent or less and less than 30 percent for the six CCCs, then the RF is assumed to be constant over the calibration range and the average RF can be used for quantitation.

If the RSD of the target analytes exceeds the 15 percent criterion, other calibration options can be employed. As discussed in Section 7.0 of Method 8000, linear calibration using a least squares regression may be used with the initial calibration data to demonstrate the instrument calibration linearity. Least squares regression was used for the target analytes listed above, which did not have an average RF of 15 percent or less. For initial calibration to be accepted using a least squares model, the coefficient of determination must be greater than or equal to 0.99.

Initial calibration of GC/MS #1 was performed on August 23, 2004 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #1 was used to analyze all samples included in this group. All target analytes and CCCs met the 15 percent calibration criteria except for acetone, bromochloromethane, bromoform and 1,2-dibromo-3-chloropropane. The coefficient of determination exceeded 0.99 for

these four compounds. All criteria for initial calibration were met for all compounds and no qualification is necessary.

Initial calibration of GC/MS #33 was performed on August 23, 2004 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #33 was used to re-analyze sample OW1 at a dilution factor of 400x on September 10, 2004. All target analytes and CCCs met the 15 percent calibration criteria for GC/MS #33 except for bromoform, 1,2-dibromo-3-chloropropane, 1,1,2,2-tetrachloroethane and 2-chloroethyl vinyl ether. The coefficient of determination exceeded 0.99 for these four compounds. All criteria for initial calibration of GC/MS #33 were met for all compounds and no qualification is necessary.

Initial calibration of GC/MS #13 was performed on August 25, 2004 using a minimum of five concentrations ranging from 0.5 to 200 µg/L, which meet the method requirement of initial calibration using five concentration levels. GC/MS #13 was used to re-analyze sample OW1K on September 9 and 10, 2004 at dilution factors of 100 and 2500, respectively. All target analytes and CCCs met the 15 percent calibration criteria for GC/MS #13 except for bromoform, 2-chloroethyl vinyl ether, 1,1,2,2-tetrachloroethane, 1,2,3-trichloropropane and naphthalene. The coefficient of determination exceeded 0.99 for these compounds. All criteria for initial calibration of GC/MS #13 were met for all compounds and no qualification is necessary.

III. CONTINUING CALIBRATION

The initial GC/MS calibration is verified once every 12 hours by analyzing a 4-bromofluorobenzene tuning standard and a calibration verification standard (a midpoint check standard) and prior to analyzing any samples. The calibration verification standard must contain each of the five SPCCs used during initial calibration. The minimum RF for each SPCC must meet the criteria specified for initial calibration (i.e., 0.10 to 0.30). In addition, initial calibration is checked using the CCCs used during initial calibration. If the percent difference (%D) of each of the CCCs is less than 20 percent, the initial calibration is assumed to be valid.

Samples were analyzed on September 8, 2004 (GC/MS #1), 9 (GC/MS #13) and 10 (GC/MS #33), 2004. Prior to sample analysis, a 50 ng BFB tuning standard was analyzed. Mass ion abundance criteria were met for the system. Each of the five SPCCs and the six CCCs were contained in a mid-point check standard at concentrations of 25 ppb. The RF for each of the SPCCs was greater than the criteria specified and the %D between the continuing calibration and the initial calibration for each of the CCCs was less than 20 percent for each batch of samples. Therefore, the initial calibrations were validated and continuing calibration criteria were met.

IV. METHOD BLANKS

A method blank must be analyzed with each batch of samples for each matrix type immediately after initial calibration is verified and before sample analysis. A total of four method blanks were reported, which correspond to the four analytical batches. Except for methylene chloride, no target analytes were detected at concentrations

above their respective reporting limits in the blanks analyzed on September 8, 9 and 10, 2004. Methylene chloride was detected in the method blank analyzed on September 8, 2004 at a concentration of 0.78 ug/l, which is below the reporting limit of 5 ug/l. Methylene chloride was also detected in sample OW1b at an estimated (i.e., below reporting limit) concentration of 1.2 ug/l. Because this concentration is less than 10 times the method blank concentration, the result was qualified with a "U" to indicate a non-detectable concentration.

V. SURROGATES

Three surrogate spikes (dibromofluoromethane, toluene-d8 and 4-bromofluorobenzene) were added to each environmental sample, QC sample, and method blank, as required by the method. Surrogate control limits were established by the laboratory and are 80 to 120 percent for all three surrogates.

All surrogate recoveries were within the acceptable control limits.

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Four MS and MSD sample sets were analyzed with this group of samples. Acceptance limits for MS and MSD recoveries and the relative percent difference (RPD) between the MS and the MSD were statistically determined by the laboratory and were provided with the laboratory report for each analyte.

Except for PCE in one batch of samples, the percent recoveries for all other MS and MSD samples were within the acceptance criteria for all spiked compounds. PCE was reported in the MS analyzed on September 8, 2004 at 64 percent, which is slightly below the lower control limit of 70 percent. Because the MSD and LCS recoveries were both within acceptable limits, qualification of the data was not warranted. Therefore, no further action was required.

The relative percent difference (RPD) between the MS and MSD samples were within acceptable criteria for all compounds in each of the analytical batches. Therefore, acceptable precision was demonstrated.

VII. LABORATORY CONTROL SAMPLES (LCS)

Four LCS samples were analyzed, which meets the analytical method requirement of one LCS per analytical batch. Results from the LCS sample were included in the analytical report. All LCS analyte recoveries were within the acceptance limits established by the laboratory, which demonstrates acceptable accuracy.

VIII. REGIONAL QUALITY ASSURANCE AND QUALITY CONTROL

Sample OW1k was submitted as a field duplicate of OW1. The RPDs between the sample and its duplicate exceeded the recommended criteria of 20 percent for three analytes (PCE, 1,1,1-TCA and TCE). Although slightly poor precision was demonstrated, it was likely the result of analyzing the two samples at different dilution factors. Both samples contained extremely high analyte concentrations. The original sample was analyzed at a dilution of 400; whereas, the duplicate sample was

analyzed at a factor of 100. Because the detected analyte concentrations in both samples were generally within the same order of magnitude, the precision deficiency is not considered significant enough to qualify the results.

IX. INTERNAL STANDARDS

Internal standard (IS) area counts and retention times for samples analyzed on September 8 through 10, 2004 were within validation criteria. IS area counts for all samples analyzed were within -50 - +100 percent of the IS area count from the daily calibration standard. IS retention times were within ± 30 seconds from the retention time of the associated daily standard.

X. TARGET COMPOUND IDENTIFICATION

All positive compound identifications were confirmed through the mass spectra library.

XI. COMPOUND QUANTITATION

Several positive results were recalculated to ensure that compound quantitation was accurate. No errors were encountered. Compound quantitation was based on the initial calibration average RF.

XII. SYSTEM PERFORMANCE

The system performance was acceptable.

XIII. OVERALL ASSESSMENT OF VOC DATA

All QC criteria evaluated during data validation of the VOC analyses were within acceptable limits. No QC issues were encountered that were significant enough to reject the data. One result (methylene chloride in the sample collected from well OW1B), however, was qualified as non-detectable due to method blank contamination. All other VOC data can be used as reported and meet the project objectives.

1,4-DIOXANE DATA ASSESSMENT

Three samples were analyzed for low-level 1,4-dioxane. Because there is no analytical method promulgated by EPA for the analysis of low-level 1,4-dioxane, Del Mar followed a modified EPA Method 8270C method, using isotopic dilution with GC/MS. Method 8270C QC criteria were used during this review to assess data for general compliance. Data reviewed for the 1,4-dioxane analyses include: holding times, instrument calibration, blank results, LCS recoveries, and MS/MSD recoveries and precision.

I. TECHNICAL HOLDING TIMES

According to Method 8270C, the holding time for 1,4-dioxane in water is 7 days from sample collection until extraction; and 40 days from extraction to analysis. The samples were extracted on August 31, 2004, which is four days from sample collection, and analyzed on September 1 and 15, 2004. Therefore, all holding times were met.

II. INITIAL CALIBRATION

Initial calibration of GC/MS #5 was performed on August 17, 2004, using seven standard concentrations ranging from 0.2 to 10 ug/L, which meet the 8270C requirement of initial calibration using five concentration levels. The percent relative standard deviation (%RSD) of the response factors over the entire calibration curve was 5.51 percent, which meets general criteria (specified in Method 8000) of less than 15 percent. Therefore, the calibration curve was considered linear.

III. CONTINUING CALIBRATION

The initial calibration of GC/MS #5 was verified prior to sample analysis by analyzing a 2 ug/L standard (mid point of the curve). The difference between the continuing calibration verification standard and the initial value was 8 percent on September 1 and 7.3 percent on September 15, 2004, which demonstrate that the initial calibrations were valid.

IV. METHOD BLANKS

Method blanks were analyzed with the two batches of samples to verify that the instrument is free from contamination. 1,4-Dioxane was not detected at a concentration above the reporting limit of 0.5 ug/L in the method blank. Therefore, no further action is required.

V. LABORATORY CONTROL SAMPLES (LCS)

One LCS sample was analyzed with this batch of samples, which meets Method 8270C criteria. Results from the LCS sample were included in the analytical report. The LCS recovery for 1,4-dioxane in the batch of samples was 63 percent, which is within the acceptable range of 35 to 120 percent (established by Del Mar). Therefore, acceptable accuracy was demonstrated and no further action is required.

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Due to high analyte concentrations in the source sample, MS and MSD recoveries were not reported with this batch of samples. Acceptable accuracy was demonstrated by the successful analysis of the LCS.

VII. REGIONAL QUALITY ASSURANCE AND QUALITY CONTROL

Sample OW1k was submitted as a field duplicate of OW1. The RPD between 1,4 dioxane concentrations was 19 percent, which is within the acceptable limit of 20 percent. Therefore, acceptable precision was demonstrated.

VIII. INTERNAL STANDARDS

Internal standard (IS) area counts and retention times for samples analyzed on September 1 and 15, 2004 were within validation criteria. IS area counts for all samples analyzed were within -50 - +100 percent of the IS area count from the daily calibration standard. IS retention times were within ± 30 seconds from the retention time of the associated daily standard.

IX. TARGET COMPOUND IDENTIFICATION

All positive compound identifications were confirmed through the mass spectra library.

X. COMPOUND QUANTITATION

Positive results were recalculated to ensure that compound quantitation was accurate. No errors were encountered. Compound quantitation was based on the initial calibration average RF.

XI. SYSTEM PERFORMANCE

The system performance was acceptable.

XII. OVERALL ASSESSMENT OF 1,4-DIOXANE DATA

Although no EPA method exists for the analysis of low-level 1,4-dioxane, the project data were reviewed for general compliance with standard QC criteria requirements specified for organic analyses. Also, QC sample results were evaluated against laboratory specified acceptance criteria for method compliance. No significant QC issues were encountered during the data review. Therefore, the 1,4-dioxane data can be used for the project purposes without qualification.

Revised Report Addendum for
Additional Data Collection in the
Phase 1A Area

**Omega Chemical Superfund Site
Whittier, California**

January 11, 2005

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Submitted to:

U.S. Environmental Protection Agency
Region IX

Prepared for:

Omega Chemical Site PRP Organized Group

Prepared by:

18581 Teller Avenue, Suite 200
Irvine, California 92612

Project No. 10500-37240.T1.GW.REPORT

The information contained in the document Revised Report Addendum for Additional Data Collection in the Phase 1a Area Omega Chemical Superfund Site, dated January 11, 2005, has received appropriate technical review and approval. The conclusions and recommendations presented represent professional judgments and are based upon findings from the investigations and sampling identified in the report and the interpretation of such data based on our experience and background. This acknowledgement is made in lieu of all warranties, either expressed or implied. The activities outlined in this report were performed under the supervision of a California Registered Geologist.

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Reviewed and Approved by:

Sharon Wallin, R.G.
Project Manager

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Section 1

Introduction

On behalf of the Omega Chemical Site PRP Organized Group (OPOG), Camp Dresser & McKee Inc. (CDM) has prepared this Revised Report Addendum for Additional Data Collection in the Phase 1a Area of the Omega Chemical Superfund Site (Site). The Site is located at 12504 East Whittier Boulevard in Whittier, California (see Figures 1-1, 1-2, and 1-3 for illustrations of Site location, vicinity, and Phase 1a area, respectively). The activities described in this document were performed in partial fulfillment of Tasks 1 and 3 of the Statement of Work included in Consent Decree No. 00-12471 between USEPA and OPOG. The Consent Decree was lodged on November 24, 2000 and entered into the U.S. District Court on February 28, 2001.

1.1 Background

Under USEPA Administrative Order 95-15, OPOG performed an initial investigation of the Phase 1a area (see Figure 1-3) during June and July 1999 in accordance with the Final Sampling and Analysis Plan (SAP) Phase 1a Field Investigation (CDM, April 23, 1999). As part of the initial investigation, three groundwater monitoring wells (OW1b, OW2 and OW3) were installed in the Phase 1a area and sampled. An existing on-site well (OW1) was also sampled. In addition, well OW2 was test pumped at four steps (1.15, 2.50, 3.75, and 5.50 gallons per minute [gpm], respectively), with each pumping step lasting approximately one hour.

The results of the initial investigation were detailed in the USEPA-approved Phase 1a Pre-Design Field Investigation Report (CDM, October 13, 1999). The Phase 1a report recommended the following to assist in selecting the most appropriate location for groundwater containment.

- ϵ Additional confirmatory sampling to verify the volatile organic compound (VOC) concentrations detected in newly-installed Omega well OW1b
- ϵ Additional investigations to further understand hydraulic conductivity and transmissivity conditions along or downgradient of Putnam Street
- ϵ Installation of a sentinel well on Washington Boulevard to characterize the lateral variability of hydrostratigraphic conditions and assist in determining if the low permeability conditions indicated at OW2 and OW3 are laterally continuous and persistent, or if preferential pathways of higher hydraulic conductivity exist

With the approval of the Phase 1a Report, OPOG completed all work required by Order 95-15 and negotiated the current Consent Decree (No. 00-12471) with USEPA.

In accordance with Task 3 of the current Consent Decree, OPOG installed four downgradient wells (formerly referred to as sentinel wells). The four wells (OW4a, OW4b, OW5 and OW6) were installed during March through August 2001 in accordance with the USEPA-approved Downgradient Well Installation and

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Groundwater Monitoring SAP (CDM, April 20, 2001). The Downgradient Well SAP also specified the collection of quarterly groundwater samples and monthly water level monitoring for one year from all Omega wells. Groundwater samples were collected from the Omega wells during mid-May, mid-August, and mid-November 2001 and mid-February 2002.

In May 2001, USEPA requested that OPOG install and sample an additional groundwater monitoring well upgradient of the site. Additional data requirements for the proposed groundwater remedy were also discussed in a Technical Memorandum from OPOG to USEPA dated October 31, 2001. The Technical Memorandum identified the following additional data requirements:

- £ Installation of a third monitoring well at Putnam Street, between wells OW2 and OW3, to verify the lateral distribution of VOCs at this location and to collect additional hydrostratigraphic and hydraulic data at this location;
- £ Performance of single well aquifer recovery tests at wells OW2, OW3, OW4a and the new Putnam Street well location to provide better estimates of hydraulic conductivity at these locations; and
- £ Addition of 1,4-dioxane, metals, bioparameters (e.g., electron donors and receptors), total dissolved solids (TDS), total organic carbon (TOC), and chemical oxygen demand (COD) to the analytical suite for the next round of sampling at wells OW1, OW1b, OW2, OW3, OW4a and OW4b.

Wells OW7 (upgradient well) and OW8 (Putnam well) were installed and sampled in March 2002. Well drilling, installation, development, and sampling activities were performed in accordance with the procedures specified in the Downgradient Well SAP.

Following the completion of quarterly sampling and monthly water level monitoring in mid-February 2002, OPOG initiated semi-annual sampling of all 10 Omega wells. Semi-annual sampling was performed during mid-August 2002 and mid-February 2003 in accordance with the SAP Addendum for Additional Data Collection in the Phase 1a Area (CDM, May 31, 2002). The additional data requirements listed above from the Technical Memorandum formed the basis of the activities described in the SAP Addendum. In addition to groundwater monitoring, the SAP Addendum also specified short-term constant discharge and recovery aquifer testing and sampling of wells OW2, OW3, OW4a and OW8. Aquifer testing and sampling of these wells was performed mid-March 2003.

A draft Report Addendum presenting the results of the additional data collection activities (semi-annual groundwater sampling and water level monitoring, and aquifer testing and sampling), in addition to prior quarterly groundwater sampling and monthly water level monitoring activities was submitted to USEPA in June 2003 (CDM, June 27, 2003, Report Addendum for Additional Data Collection in the Phase 1a Area). USEPA comments to the draft report were provided in correspondence

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dated October 15, 2003. USEPA requested that these comments be incorporated into future data collection activities and subsequent versions of the Phase 1a report. This document, therefore, has been revised to address the USEPA's comments to the draft report.

On November 11, 2003, a memorandum describing the proposed scope of work for additional data collection activities in the Phase 1a area was submitted to USEPA. The memorandum proposed the following additional data collection activities in the Phase 1a area: eight off-site soil borings (four at the Terra Pave property and four along Putnam Street), the installation of piezometers at two of the Putnam Street boring locations, and a 12-hour constant rate aquifer test of well OW8. The memorandum also recommended that four on-site borings proposed in the On-Site Soils RI/FS Work Plan (CDM, September 29, 2003) be advanced and sampled early (i.e., prior to initiation of the RI/FS field program). USEPA comments to the memorandum were provided in correspondence dated December 2, 2003. The work proposed in the memorandum was implemented during October and November 2003. During March and April 2004, additional background water-level data were collected from wells OW1, OW1b, OW4a, OW4b, OW7, and OW8 in order to evaluate the typical range in variation in water levels at the site.

Additional semi-annual sampling was also performed during August 2003, February 2004, and August 2004. In addition, as requested by USEPA, an additional deeper well (OW8b) was installed in August 2004. The results of these additional activities have also been incorporated into this revised report.

Boring/Well Construction Logs for all 11 Omega wells are provided in Appendix A. Electric logs for wells OW4b and OW8b, which were drilled using mud rotary methods, are also provided in Appendix A.

USEPA has also been performing a regional groundwater investigation in areas downgradient of the Site to identify additional sites which may have contributed to groundwater contamination in the area. Phase 1 of the regional groundwater investigation was performed for USEPA by Roy F. Weston, Inc. (Weston) during the period from August 15 through November 2, 2001. The Phase 1 investigation included the analysis of 81 in-situ groundwater samples collected using a push-probe drill rig, temporary well screen, and bailer. In addition, 30 exploratory boring were advanced during the Phase 1 investigation using a cone penetrometer (CPT) drill rig. The results of the Phase 1 investigation were presented in the Phase 1 Groundwater Characterization Study (Weston, February 2002). Weston also installed and sampled 18 groundwater monitoring wells as part of a subsequent Phase 2 investigation. USEPA also collected split samples for laboratory analysis from all Omega wells during the quarterly and semi-annual sampling events. Sampling of the regional wells is currently being performed for USEPA by CH2MI lll.

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1.2 Purpose and Objective

As described above, the purpose of the investigation detailed in this Report Addendum was to collect additional data (e.g., lithologic, water quality, aquifer hydraulics, etc.) in order to assist in the selection of the groundwater remedy in the Phase 1a Area. This document summarizes the results of the additional investigation

1.3 Organization of Report

This report is organized into five sections, as follows:

- Section 1 - Introduction
- Section 2 – Field Procedures
- Section 3 – Data Presentation and Evaluation
- Section 4 – Conclusions and Recommendations
- Section 5 – References
- Appendix A – Boring/Well Construction Logs, MIP Screening Results, and Electric Logs
- Appendix B – Completed Field Forms
- Appendix C – Well Survey Data
- Appendix D – Analytical Reports and COCs
- Appendix E – Aquifer Test Data
- Appendix F - Fate and Transport
- Appendix G – Hydrographs and Time-Series Plots
- Appendix H – Data Validation

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Figures and tables are provided at the rear of each section where they are first discussed. In response to USEPA's October 15, 2003 comments, detailed cross-sections (Figures 3-22 and 3-23) were developed for this revised report. The Site base map was also revised to more accurately depict the location and configuration of buildings and streets in the surrounding areas. The groundwater elevation contour maps and all other Section 3 figures have been revised to incorporate the new base map features.

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Section 2

Field Procedures

As discussed in Section 1, two tasks were performed during the initial Phase 1a field investigation in accordance with the SAP Addendum:

- Task 1 - Aquifer Testing and Water Quality Sampling and Analysis
- Task 2 - Semi-Annual Monitoring Well Sampling and Analysis

Additional tasks recommended in the November 11, 2003 memorandum were also performed, as follows (for ease of review, the additional task has been identified as Task 3 in this document):

- Task 3 - Drilling and Soil Sampling

Task 1 above was also expanded per the November 11, 2003 memorandum to include additional longer-term testing of well OW8. A brief discussion of field procedures is provided below.

2.1 Task 1 - Aquifer Testing and Water Quality Sampling and Analysis

Wells OW2, OW3, OW4a and OW8 were tested during the period from March 10 through March 14, 2003 using the single borehole recovery method. An aquifer performance test was conducted by pumping well OW8 and monitoring the response at wells OW1b, OW2, OW3, OW4a, and OW7, and piezometers PZ-1 and PZ-2 between November 19 and November 20, 2003. In addition, water levels were monitored using a pressure transducer during March and April 2004 at wells OW1, OW1b, OW4a, OW4b, OW7 and OW8 to assess background groundwater level fluctuations. Section 2.1.1 provides procedures for aquifer testing, while Section 2.1.2 provides the procedures for the water quality sampling.

2.1.1 Aquifer Testing

2.1.1.1 Single Borehole Tests

A submersible pump was used to perform a 4-hour single borehole aquifer performance test at each of the four well locations, with recovery measured until the water level at each tested well had recovered to within approximately 95 percent of its pre-test static condition.

CDM metered discharge during each test and collected totalizer readings at the beginning and end of the pumping period from an in-line flow meter. Due to some flow adjustments made during testing, a constant discharge rate was difficult to maintain for OW-2, 3, and 4A and totalizer readings were used to estimate the average pumping rate for the entire test period. Therefore, the average pumping rate calculated from the totalizer readings may not reflect the true rate at any specific

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<#>OW2 - 2.3 gpm ¶
<#>OW3 - 1.34 gpm ¶
<#>OW8 - 10.4 gpm ¶
<#>OW4a - 10.3 gpm ¶

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period during the test. Periodically during pumping, samples of the discharge water were collected for field measurement of pH, temperature, electrical conductivity, and turbidity. Field measurements were recorded on the Aquifer Pump Test Data sheets contained in Appendix B. Equipment decontamination was performed as described in Section 4.8 of the Downgradient Well SAP. The following average pumping rates were determined for each test:

- OW2 - 2.3 gpm
- OW3 - 1.34 gpm
- OW8 - 10.4 gpm
- OW4a - 10.3 gpm

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Water levels prior to initiating each test and during the pumping and recovery phases of each test were monitored automatically using a data logger and transducer (In-Situ Mini-Troll™), and confirmed manually using an electric water level indicator. Equipment operation was performed in accordance with manufacturer's instruction manuals. Manual and transducer monitored water levels showed good agreement, so only the transducer data are used in the analysis. Water levels were sufficiently stable prior to the test, so no trend corrections were applied to the data. Manual water level readings were generally collected on a typical logarithmic progression (e.g., every minute during the first ten minutes of the test, every two minutes from 10 to 20 minutes into the test, every 5 minutes from 20 to 30 minutes into the test, every 10 minutes from 30 to 60 minutes into the test, etc.). The data logger also collected water level measurements using its pre-set logarithmic progression. Manual measurements are provided on the field forms contained in Appendix B.

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A total of 6,326 gallons of water were generated during the four tests. The water was pumped directly into a vacuum truck. Upon the completion of testing at each location, the purge water was transported under non-hazardous waste manifest to the Demunno/Kerdoon (DK) facility in Compton, California for recycling. Because well purge water from previous sampling events in 2001, 2002, and 2003 had also been recycled by the DK facility, a disposal profile had been established for the water and further analysis was not required prior to disposal.

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2.1.1.2 Aquifer Performance Test

A multi-well aquifer performance test was conducted between November 19 and 20, 2003 by pumping well OW8 and monitoring water levels at wells OW1b, OW2, OW3, OW4a, and OW7, and piezometers PZ-1 and PZ-2. The aquifer pumping test was preceded by short term pumping to verify long term rates and to test equipment.

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A submersible pump was used for all pumping of OW8. Flow at OW8 was monitored using an in-line flow meter with a totalizer. The flow rate was monitored and adjusted during the early part of the test to a nominal 11 gpm. Pumping rates did

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fluctuate during the first 2 hours of the test to rates as low as 5 gpm for short periods. Flow rates remained stable till near the end of the test, when a 90 second shutdown occurred during refueling of the generator. A total of 12,973 gallons of water were pumped over 1,184 minutes (19.73 hours), resulting in an average flow rate of 10.96 gpm. Owing to the presence of various organic compounds in the discharge water, it was necessary to containerize the pumped water in a portable tank for disposal at an off-site facility.

Water levels were monitored prior to testing, in addition to during the pumping and recovery periods at the noted wells using pressure transducers and data loggers. Initial settings for transducers were based on manual water level measurements. All analyses were conducted using the transducer readings. Water levels prior to the test varied only within a few hundredths of a foot, so no corrections were applied to the data. Additional monitoring was conducted during winter 2004 at several wells on site to assess the range in variation in water levels typical at the site.

2.1.2 Water Quality Sampling and Analysis

Water quality samples were collected from each pumped well just before the termination of pumping. One sample was collected from each well and submitted for analysis of the following parameters on a standard turnaround basis:

- VOCs plus acetone, Freon 11, Freon 12, Freon 113, MTBE (methyl-tertiary-butyl-ether) and Tentatively Identified Compounds (TICs) by Method 8260B
- 1,4-Dioxane by Method 8270M

The discharge rate was slowed to less than one gpm during sample collection. The sample containers were filled directly from the end of the discharge pipe. One sequential duplicate sample was also collected from well OW8 during the March 2003 testing. Sample collection and handling was performed as described in the following section. Analytical reports and completed COC forms for analytical samples collected during aquifer testing are contained in Appendix D.

2.2 Semi-Annual Monitoring Well Sampling and Analysis

In accordance with the SAP Addendum, all Omega wells will be sampled on a semi-annual basis until the Phase 1a Area treatment plant is operational. As previously discussed, semi-annual sampling was initiated during mid-August 2002. To date, five semi-annual sampling events have been completed (mid-August 2002, mid-February 2003, mid-August 2003, mid-February 2004, and mid-August 2004). Groundwater samples collected from the Omega wells and duplicates were analyzed for the following parameters at a fixed-base laboratory during the five semi-annual sampling events performed to date:

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- VOCs plus acetone, Freon 11, Freon 12, Freon 113, MTBE (methyl-tertiary-butyl-ether) and Tentatively Identified Compounds (TICs) by Method 8260B

In addition, groundwater samples collected from selected wells (OW1, OW1b, OW2, OW3, OW4a, OW4b, and OW8) were analyzed for 1,4-dioxane by Method 8270M during the mid-August 2002 and mid-February 2003 sampling events. During the three most recent sampling events (mid-August 2003 through mid-August 2004), samples for 1,4-dioxane analysis were collected from all Omega wells.

In accordance with Section 2.2 of the SAP Addendum and as described below, all wells were purged using a portable submersible pump and dedicated polyethylene tubing. Purge volume was determined by measuring the water level and bottom of each well, and then calculating three saturated casing volumes. The amount of water contained in the gravel pack was also estimated, multiplied by three, and added to the purge volume. At locations where the well pumped dry (i.e., OW1 and OW1b), the well was sampled later that day or early the next morning following water level recovery.

As previously described in Section 2.1.1, samples of the discharge water were collected periodically for field measurement of pH, temperature, electrical conductivity, and turbidity. Upon the completion of purging, with the exception of samples for VOC and 1,4-dioxane analyses, the discharge rate was lowered to less than 1 gpm and sample containers were filled directly from the end of the discharge tubing. The portable pump was then removed from each well and a pre-cleaned, disposable bailer lowered to the approximate middle of the perforated section was used to collect samples for VOC and 1,4-dioxane analyses. The sample containers were filled pouring directly from the top of the bailer, exercising care to minimize agitation.

Field measurements for all semi-annual sampling events are indicated on the Monitoring Well Purge and Sampling forms contained in Appendix B. Analytical reports and completed COC forms for analytical samples collected during the semi-annual sampling events are contained in Appendix D.

As indicated in the Technical Memorandum (OPOG, October 31, 2001), additional analyses for biodegradation/natural attenuation parameters and emerging compounds were also performed on groundwater samples collected from selected wells (OW1, OW1b, OW2, OW3, OW4a, OW4b and OW8) during the February 2003 semi-annual sampling event. Analyses of the field parameters listed below were performed in accordance with manufacturer's directions provided with each Direct Reading Instrument (DRI) and Hach Test Kit.

Biodegradation/Natural Attenuation Field Parameters

The following biodegradation/natural attenuation parameters were analyzed immediately in the field:

- Dissolved Oxygen (DO) *

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- Redox (Eh) *
- Sulfate **
- Iron (II) **
- Alkalinity **
- Chloride **
- Hydrogen Sulfide **
- Carbon Dioxide **

* Indicates field analysis using a DRI (Orion 250A for Eh and YSI 55 for DO).

** Indicates field analysis performed per manufacturer's instructions using a Hach Company (Loveland, Colorado) test kit.

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Biodegradation/Natural Attenuation Analytical Parameters (fixed-base laboratory)

The following parameters were analyzed by a fixed-base laboratory:

- Nitrate/Nitrite (Method 300.0)
- Dissolved Organic Carbon (DOC, Method 415.1)
- Methane/Ethane/Ethene (if field tests indicated conditions were anaerobic) (Methane by Method AM20GAX and Ethane/Ethene by Method AM18)

Sample handling was performed as indicated in Section 3 (Table 3-1) of the SAP Addendum. Laboratory samples for dissolved organic carbon analysis were collected in un-acidified containers, and filtering by the lab was indicated on the Chain of Custody (COC) form. Field personnel coordinated with the analytical laboratory to make sure that analyses with short holding times (e.g., nitrate/nitrite and hexavalent chromium) were analyzed within the required holding time.

In accordance with the SAP Addendum, bottles were filled for methane/ethane/ethene analyses and stored in an iced cooler pending evaluation of the dissolved oxygen measurements and ferrous iron (Fe II) field analytical results for the sampled wells. According to the SAP Addendum, in the event that anaerobic conditions were observed at a sampled well location (e.g., ferrous iron was detected during field testing and DO measurements were less than 1 mg/L), the bottles filled for methane/ethane/ethene analyses were to be submitted to the fixed-base laboratory for analysis. Methane/ethane/ethene are metabolic byproducts produced only under reduced, anaerobic environments. Methane is produced through carbon dioxide reduction and/or fermentation reactions, while ethane and ethane are innocuous end-products that result from the reductive dechlorination of chlorinated VOCs. In the absence of anaerobic conditions, methane/ethane/ethene generation is likely be insignificant, therefore, analysis for these compounds was unwarranted. Based on evaluation of the field results, three samples (OW1, OW1b, and OW8) were selected for methane/ethane/ethene analyses.

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Emerging Compounds (fixed-base laboratory)

The following additional parameters were also analyzed by a fixed-base laboratory:

- Hexavalent Chromium (Method 218.6)
- 1,4-Dioxane (Method 8270C)
- Perchlorate (Method 314.0)

Well Purging and Sampling Procedures

Each well was purged using a portable submersible pump and dedicated polyethylene tubing previously installed inside each Omega well. Upon the completion of purging, with the exception of samples for VOC and 1,4-dioxane analysis, all sample containers were filled directly from the end of the discharge tubing, with the discharge rate lowered to less than one gpm during filling of the sample containers.

Upon the completion of sample collection using the submersible pump, the pump was removed from the well and a pre-cleaned, disposable bailer lowered to the approximate middle of the perforated section. The bailer was used to collect samples for VOCs and 1,4-dioxane analyses. The groundwater contained in the bailer was poured directly into the sample containers, minimizing agitation. After sampling was completed, the bailer and line were discarded.

All samples were submitted for standard analytical turnaround time. Level 4 deliverables were requested on approximately 10 percent of the samples submitted for fixed-base laboratory analysis during each sampling event, in order to perform formal validation of the data. Data validation results are discussed in Section 3.6. The laboratory provided both electronic and hard copy reports.

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Water Level Measurements

Water level measurements were also collected from the Omega wells prior to each sampling event. Water level measurements and water quality sampling activities were performed in accordance with the procedures specified in Sections 2.1.4 and 2.1.5 of the Downgradient Well SAP, respectively.

2.3 Drilling and Soil Sampling

Eight borings (GP1 through GP8) were advanced and sampled during October 2003 using the direct-push drilling method. Borings GP1, GP2, GP3, and GP6 were located on the Omega site, with borings GP5, GP5, GP7, and GP8 located on the adjacent Terra Pave property.

A specialized down-hole tool (Membrane Interface Probe [MIP]) was utilized at three of the boring locations (GP4 through GP6) to collect continuous total VOC screening information during drilling. The MIP screening results (see Appendix A) were used to select 3 to 4 soil samples per boring for laboratory analysis of VOCs. A fourth location (GP3) was originally proposed for MIP screening. During drilling at the

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location of GP3 (former 500 gallon kerosene UST), however, gravel backfill was encountered to a depth of 7 feet bgs. The boring was subsequently advanced to 35 feet bgs but had to be abandoned due to gravel falling down the boring which prevented advancing the boring below 35 feet bgs. The replacement boring (GP3A) was relocated a short distance to the south of the former UST location. Due to indications of contamination (i.e., odor) noted at location GP3, it was determined in the field to forego MIP screening at location GP3A and instead collect additional soil samples for VOC and 1,4-dioxane analyses. A total of eight soil samples were subsequently collected for laboratory analyses at approximate 10-foot intervals in the interval from 10 to 85 feet bgs.

Four borings (B1 through B4) were advanced along Putnam Street during November 2003 using the sonic drilling method. Each boring was continuously cored for lithologic description purposes. Two of the borings (B1 and B2) were converted to 2-inch diameter piezometers (PZ1 and PZ2, respectively).

Well OW8b was installed on Putnam Street during August 2004 using the direct mud rotary drilling method. During drilling, soil cuttings were collected from the drilling fluid and logged. Electric-logging (16 and 64-inch resistivity, 6-foot lateral resistivity, point, spontaneous potential, and gamma) was also performed in the boring after it had been advanced to its maximum depth (144 feet bgs).

Boring and well locations are illustrated on Figure 3-21. Boring logs, well and piezometer completion details, and geophysical logs are provided in Appendix A. Survey results (wellhead location coordinates and elevation) for new well OW8b, new piezometers PZ1 and PZ2, and all other Omega wells is provided in Appendix C.

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interval of well OW8 are slightly coarser-grained (very fine to coarse sands) than the subsurface materials adjacent to the screened interval of well OW2 (very fine to fine sands).

Additional lithologic data along Putnam Street obtained from piezometers PZ1, PZ2 and well OW8 indicate that the uppermost aquifer in this area is comprised of sand, silty sand and well graded gravel containing significant silt. The aquifer is interbedded, and in the area between PZ1 and PZ2 contains a finer grain interval separating the upper and lower portion of the aquifer. The deep well (OW8b) indicates that a clay separates the upper aquifer from the next deeper sandy interval that was screened in this well.

The subsurface materials adjacent to the screened interval of well OW4a are generally coarser-grained (fine to coarse sands with some gravel), and consist of sands and silty sands interbedded with clays and silty clays. Due to flowing sands encountered at location OW4, the deeper well (OW4b) was drilled using the mud rotary drilling method vs. the hollow-stem auger method used to drill and install the other 9 Omega wells. An electric log was performed in the OW4b boring and is included in Appendix A. The electric log correlates well with the lithologic logs at location OW4.

Detailed geologic cross-sections were constructed approximately along the groundwater flow direction and orthogonal to this flow direction along Putnam Street. Figure 3-21 shows the plan view location of these cross-sections. Cross-section A-A' (Figure 3-22) extends along an approximate groundwater flow line extending from OW7, upgradient of the site, to OW4 downgradient of the site. Shallow deposits in the vadose zone consist primarily of fine-grain deposits. This section illustrates the presence of the two aquifer zones present at the site, separated by a low permeability confining zone. The upper aquifer zone appears to 'pinch out' in the area upgradient (east) of Putnam Street. A relatively thick sand sequence is observed at OW4 and OW8, that thins dramatically at borings GP-7 and GP-1. This sandy zone is absent at boring GP-2. The deeper sand zone is only observed at locations OW4 and OW8, which extended to a sufficient depth. Well OW1b extended to a similar depth, however, sandy lithologies were not encountered at this boring. Based on water levels at the OW4 and OW8 locations, where both deep and shallow zone completions are available, the groundwater elevations are significantly higher in the shallow aquifer. A similar difference in water level, with an indicated downward gradient was observed at the cluster at OW1/1b. This indicates that a significant confining zone limits flow between these zones. This issue will be discussed further in Section 3.3.1.

An additional cross-section was constructed approximately along Putnam Street, at a right angle to the general flow direction. Cross-section B-B' (Figure 3-23) incorporates boring logs available in EPA files for other sites. This section indicates that the shallow aquifer may pinch out to the north, since it was not encountered in borings north of H-7. The shallow aquifer configuration shows the presence of a lower permeability zone splitting the upper aquifer north of PZ1. Boring B-4 indicates a thick sand sequence suggesting that the lower permeability split was eroded, or never

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deposited, resulting in good hydraulic connection within the upper aquifer at this location. The uppermost sand unit within the upper aquifer appears continuous below the water table elevation from H-7 at the northern end to B-3 at the southern end of the section. A clayey gravel is present at a similar depth in OW3 that is also part of this unit.

Figure 3-24 provides a three-dimensional view of the distribution of lithologies at the site. A column representing each boring location is color-coded to indicate the relative permeability of lithologies encountered at each location. A three-tiered classification system was used on this figure, with the yellow zones indicating intervals with the highest relative hydraulic conductivity, orange indicating intermediate values and blue indicating intervals with the lowest relative hydraulic conductivity. The highest relative hydraulic conductivity class was assigned to deposits that consisted primarily of sand or gravel, with limited silt and clay content. The intermediate hydraulic conductivity class was assigned to lithologies that included primarily sand or gravel, but with significant silt or clay, which will lower the hydraulic conductivity. The lowest hydraulic conductivity class was assigned to intervals that were primarily silt or clay. This figure illustrates the limited areal extent of the upper aquifer east of Putnam near the presumed source area. Boring logs along Putnam Street and downgradient show significant high and intermediate hydraulic conductivity material is present that pinches out to the east of Putnam Street. The upper aquifer zone comprises a channel-like feature extending from near Putnam Street, toward the west. Information on the deeper aquifer is more limited, with only three wells extending to a sufficient depth. Based on this limited information, a similar trend occurs near the Omega site east of Putnam Street, where sandy intervals are very limited.

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3.2 Water Level and Groundwater Elevation Results

All Omega wells were surveyed and groundwater elevation calculated at each location using the water level measurements for each well. Groundwater elevation results are summarized in Table 3-2. As indicated on the groundwater elevation contour maps (Figures 3-2 through 3-18), the direction of groundwater flow was consistently towards the southwest during all 17 water level monitoring events.

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There is a noticeable change in hydraulic gradient in the vicinity of Washington Boulevard and the OW-4 monitoring well cluster, which corresponds to the observed transition from finer-grained subsurface lithology in the area northeast of Washington Boulevard to coarser-grained subsurface lithology in the area southwest of Washington Boulevard. During the August 2004 sampling event, hydraulic gradient upgradient of cluster well OW-4 was approximately 0.01 ft/ft, and downgradient of cluster well OW-4 it was approximately 0.003 ft/ft. A similar trend was observed during the August 2001 sampling event, with a hydraulic gradient of approximately 0.01 ft/ft upgradient of cluster well OW4 and 0.002 ft/ft downgradient of cluster well OW-4.

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As observed at the three locations where shallow and deeper well pairs (OW1, OW4 and OW8) are present, groundwater elevations in the deeper wells were consistently deeper than the elevations observed at the shallow wells at those locations. Also, as water levels have dropped over time in wells OW1/ OW1b and OW4a/ OW4b, the differences in head between the monitored zones have increased at both locations. For example, at OW1/OW1b during May 2001, the head difference between the two zones was 3.43 feet. During the most recent August 2004 sampling event, the head difference between the two wells was 9.28 feet. The well pair at OW4a/OW4b exhibited a similar trend, with a head difference of 3.76 feet in May 2001 and 8.99 feet in August 2004. The difference in head at location OW8/OW8b during August 2004 was 17.4 feet. The August 2004 sampling event was the initial sampling of newly-installed well OW8b. Subsequent sampling at OW8/OW8b will allow for additional evaluation of head differences at that location.

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As discussed previously, water quality samples were collected quarterly from all Omega wells for one year starting mid-May 2001 and ending mid-February 2002. In addition, samples were collected on a semi-annual basis starting in mid-August 2002. Semi-annual sampling is currently on-going. Analytical results for all detected compounds (laboratory and field) are summarized in Tables 3-3 through 3-9.

The following discussion of groundwater sample analytical results is limited to samples collected from wells in the Phase 1a area (OW1, OW1b, OW2, OW3, OW8, and OW8b), along Washington Boulevard (OW4a and OW4b), and the well directly upgradient from the Omega facility (OW7). Screened intervals for each well are indicated on the majority of the analytical summary tables. The results of routine groundwater sampling performed since May 2001 are discussed below.

Time-series plots for six selected compounds (PCE, TCE, Freon 11, Freon 113, 1,1-DCE, and 1,4-dioxane) were prepared to illustrate concentration changes over time. Two sets of graphs were prepared, with one set of graphs showing each individual

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compound in all eight wells, and the second set illustrating the concentrations over time of the six compounds on a per well basis. Both sets of graphs are provided in Appendix G.

3.3.1 Chlorinated VOCs

Chlorinated VOCs have been detected more frequently and at elevated concentrations in the Phase 1a area, therefore, they are the primary compounds of concern at the Site. The following discussion regarding chlorinated VOCs is based on well location with respect to distance from the assumed on-site source area, and depth (see Table 3-1 for well construction information and screened intervals). As shown on Figure 3-1, wells OW1 and OW1b are located at or in close proximity to the Site and are considered source area wells. Putnam Street wells OW2, OW3, OW8, and OW8b are located a short distance (e.g., approximately 300 feet) downgradient from the Site. As discussed previously, these six wells are located within the Phase 1a study area. Wells OW4a and OW4b are located on Washington Boulevard approximately 1,000 feet downgradient from the Site. At the three locations where a deeper well is paired with a water table well (OW1 and OW1b, OW4a and OW4b, and OW8 and OW8b), the vertical extent of chlorinated VOCs is discussed.

Source Area Wells OW1 and OW1b

Well OW1 is a water table well (screened from 62.5 to 77.5 feet bgs) located on-site and is considered a source area well. Well OW1b (screened from 110 to 120 feet bgs) is a deeper well located on the adjacent Terra Pave property, and paired with well OW1 provides information on the vertical extent of chlorinated VOCs in the general area of the assumed source.

The compound detected at the highest concentration in well OW1 during the quarterly and semi-annual sampling events was tetrachloroethene (PCE), which was detected at concentrations ranging from 30,000 micrograms per liter (ug/l) in February 2002 to 150,000 ug/l in February 2004 and August 2004 (based on the duplicate sample result). Other chlorinated VOCs detected at elevated concentrations included 1,1,1-trichloroethane (1,1,1-TCA) at a maximum concentration of 12,000 ug/l in August 2004 (based on duplicate sample result); 1,1-dichloroethene (1,1-DCE) at a maximum concentration of 2,700 ug/l in May 2001; chloroform (CFM) at a maximum concentration of 500 ug/l in May 2001 and February 2003; and methylene chloride (MC) at a maximum concentration of 490 ug/l in May 2001. During the previous four semi-annual sampling events, MC concentrations in the well have ranged from 72 to 41 ug/l. Freon concentrations in well OW1 appear to be declining over time, from a high of 1,400 ug/l (Freon 113) during August and November 2001 to 150 ug/l in August 2004 (based on the duplicate sample result). Freon 11 has exhibited a similar trend over the same time period.

Chlorinated VOCs were generally not detected in near-site deeper well OW1b. The primary exception was PCE, which was detected at concentrations several orders-of-magnitude lower in well OW1b compared to well OW1. The concentration of PCE in well OW1b ranged from 110 ug/L in August 2003 to 28 ug/l in February 2002. These

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data indicate that chlorinated VOC concentrations decline with increased depth and appear to be of limited vertical extent.

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Putnam Street Wells OW2, OW3, OW8, and OW8b

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Chlorinated VOCs were detected in water table wells OW2, OW3, OW8, and OW8b located approximately 300 feet downgradient from the Site along Putnam Street. Based on evaluation of the analytical results, the following general observations were made regarding the concentrations of chlorinated VOCs in the four wells.

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Chlorinated VOC concentrations in the three Putnam Street wells were less than those observed in the on-site source area well (OW1). For example, PCE was detected at a concentration of 13,000 ug/l in well OW8 in February 2003, compared to a concentration of 100,000 ug/l detected in on-site source area well OW1 during February 2003.

The concentrations observed in wells OW2 and OW3 were generally comparable to each other. PCE concentrations in wells OW2 and OW3 during quarterly and semi-annual sampling ranged from 610 to 2,800 ug/l and from 200 to 3,200 ug/l (in the duplicate sample collected February 2004), respectively. As indicated on the time-series plot for well OW2, the concentration of PCE has been steadily increasing in the well since August 2002.

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TCE concentrations in wells OW2 and OW3 ranged from 110 to 300 ug/l and 160 to 290 ug/l (in the duplicate sample collected February 2004), respectively. Maximum concentrations of other chlorinated VOCs detected in well OW2 were 1,000 ug/l 1,1-DCE; 1,600 ug/l Freon 113; and 390 ug/l Freon 11. Maximum concentrations of other chlorinated VOCs detected in well OW3 were 1,700 ug/l 1,1-DCE; 530 ug/l Freon 113; and 380 ug/l Freon 11. Freon concentrations in the two wells appear to be slowly declining over time.

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In comparison, the concentrations of chlorinated VOCs detected in well OW8 were generally higher than the concentrations detected in wells OW2 and OW3. Maximum concentrations of PCE, TCE, 1,1-DCE, Freon 113 and Freon 11 detected in groundwater samples collected from well OW8 were 36,000 ug/l; 2,200 ug/l; 2,600 ug/l; 2,800 ug/l and 1,000 ug/l, respectively. In addition, MC and CFM were detected at maximum concentrations of 6,500 ug/l and 2,000 ug/l, respectively, in groundwater samples collected from well OW8. By comparison, MC and CFM were detected either at low concentrations or were not detected in samples collected from wells OW2 and OW3.

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At location OW8, MC and CFM concentrations increased from the initial quarterly sampling event in March 2002 (36 and 390 ug/l, respectively) to the most recent semi-annual sampling event in August 2004 (1,700 and 6,300 ug/l, respectively). The concentration of MC detected in well OW8 during the February 2003 sampling event (930 ug/l) was higher than the concentration (72 ug/l) detected in on-site source area well OW1. The concentrations of Freon 113 and Freon 11 were also higher in well

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OW8 in comparison to the concentrations reported for well OW1. This trend was also observed during all subsequent semi-annual sampling events.

Newly-installed deeper well OW8b was sampled for the first time during the August 2004 sampling event. A low concentration of 2.1 ug/l PCE was detected in the well, and all other VOCs and 1,4-dioxane were non-detect. As discussed above, elevated concentrations of several VOCs and 1,4-dioxane were detected in groundwater samples collected from the shallow well (OW8) at this location. The observed water quality differences between wells OW8 and OW8b provide additional support for a significant confining zone that limits flow between these zones.

Washington Boulevard Wells OW4a and OW4b

Chlorinated VOCs were detected in Washington Boulevard water table well OW4a located approximately 1,000 feet downgradient from the Site. Concentrations were generally several orders of magnitude less than concentrations observed in the on-site source area well (OW1), and several times less than concentrations observed in Putnam Street wells OW2 and OW3. Chlorinated VOC concentrations, therefore, were observed to decrease with increased distance downgradient from the source area.

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The compound MC, which was detected at elevated concentrations in the groundwater samples collected from well OW8, was not detected in the samples collected from well OW4a at a detection limit of 5 ug/l. During the most recent sampling event in August 2004, an estimated concentration (i.e., below the reporting limit) of 1.1 ug/l was detected in the well. In addition, the concentration of CFM was several orders of magnitude lower in the samples collected from well OW4a in comparison with the concentration detected in samples collected from well OW8.

Low concentrations of chlorinated VOCs (e.g., 1.2 to 41 ug/l PCE) were generally detected in groundwater samples collected from deeper well OW4b during the quarterly and semi-annual sampling events. As discussed previously, well OW4b is located adjacent to well OW4a. For reference, well OW4a is screened from 49.8 feet to 69.8 bgs, with well OW4b screened from 112 to 122.3 feet bgs. During the two semi-annual sampling events in August 2002 and February 2003, PCE was detected at increased concentrations of 12 and 41 ug/l, respectively. During the August 2003 through August 2004 semi-annual sampling events, PCE decreased to 1.6 ug/l in well OW4b.

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In addition, several additional compounds (TCE, 1,1-DCE, Freon 113 and Freon 11) were also detected in groundwater samples collected from well OW4b. As was observed at the source area well pair location (OW1/OW1b), the data for the downgradient well pair (OW4a/OW4b) demonstrate that chlorinated VOC concentrations decline with increased depth and appear to be of limited vertical extent.

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Upgradient Well OW7

Several chlorinated VOCs were detected at low concentrations at the upgradient well (OW7) location. Maximum concentrations of 20 ug/l PCE, 2 ug/l TCE, 63 ug/l Freon 113, and 54 ug/l Freon 11 were detected in the upgradient well. Land use upgradient from OW7 is primarily commercial and residential. The source of this observed contamination is unknown, however, it is likely indicative of regional contamination in areas upgradient of the Site.

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3.3.2 Aromatic VOCs

Several aromatic organics have historically been detected at relatively low concentrations in on-site source area well OW1 (see Table 3-4). During the most recent August 2004 semi-annual sampling event, aromatic compounds were detected at concentrations comparable to the prior sampling events. During the August 2004 sampling event, the following aromatics were detected in groundwater samples collected from on-site source area well OW1: benzene at 7 ug/l, toluene at 9.6 ug/l, ethylbenzene at 3.1 ug/l, total xylenes at 0.55 ug/l, and isopropylbenzene at 1.5 ug/l. Historically, with the exception of sporadic low-level detections close to or below the reporting limit, aromatic organics have not been detected in deeper well OW1b. With one minor exception (acetone at an estimated [i.e., below the reporting limit] concentration of 6.1 ug/l), they were not detected during the August 2004 sampling event.

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Aromatic organics have also generally not been detected in groundwater samples collected from Putnam Street wells OW2 and OW3, Washington Boulevard well OW4a, and upgradient well OW7. Low levels of benzene (ranging from 0.79 to 1.8 ug/l) were detected in well OW4b during the August 2002 and February 2003 semi-annual sampling events, respectively. Acetone was routinely detected in well OW4b during groundwater sampling events prior to February 2004, at concentrations ranging from 28 to 1,500 ug/l. In addition, 2-propanol was also detected in the well prior to August 2002 at concentrations ranging from 350 to 940 ug/l.

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Benzene, toluene, and acetone have also been detected in groundwater samples collected from well OW8 during quarterly and semi-annual sampling events. Benzene was detected at a concentration of 5.3 ug/l during the August 2002 semi-annual sampling event. Toluene concentrations during semi-annual sampling events ranged from 1.9 ug/l (March 2002) to 340 ug/l (August 2004), and acetone concentrations ranged from 41 ug/l (March 2002) to 7,400 ug/l (August 2004). An estimated concentration (i.e., below the reporting limit) of acetone was detected at a concentration of 5.7 ug/l in deeper well OW8b during it's initial August 2004 sampling event.

Acetone concentrations in deeper well OW4b have declined from a high of 1,500 ug/l in November 2001 to below the reporting limit (8.4 ug/l in February 2004 and 5.2 ug/l in August 2004). The detection of acetone in well OW4b is believed to be a result of cross-contamination from coatings used in the manufacture of bentonite pellets at the time the well was installed. This problem was observed at many other sites where

bentonite pellets have been used for well construction. Corrective action has since been taken by the manufacturer to resolve this issue. Acetone has been consistently detected at elevated concentrations only at location OW8. Uncoated bentonite pellets were used during the construction of well OW8, therefore, the acetone detections in shallow well OW8 are likely derived from the Site or other unknown sources.

3.3.3 Semi-VOCs, Pesticides, and Metals

Semi-VOCs and pesticides were analyzed for and not detected at locations OW1 and OW1b during all four quarterly sampling events (see Table 3-5). Total and dissolved metals were also analyzed at these two well locations and were generally found at background concentrations during all four quarterly sampling events (see Table 3-6). Based on these results, sampling and analysis for these parameters was discontinued at the start of semi-annual sampling.

3.3.4 Emerging Compounds

During the February 2003 semi-annual sampling event, additional analysis for three emerging compounds (hexavalent chromium, perchlorate, and 1,4-dioxane) at selected well locations was included in the analytical suite. Perchlorate was also analyzed in wells OW1 and OW1b during the four quarterly sampling events. Analysis for 1,4-dioxane has also been performed at all well locations since the November 2001 quarterly sampling event. Emerging compounds results are summarized in Table 3-7.

Perchlorate was detected in only one well, OW4b, at a concentration of 9.4 ug/l. Hexavalent chromium was detected in wells OW2, OW3, OW4a and OW8 at concentrations of 3.1, 5.4, 12 and 1.1 ug/l, respectively, during the February 2003 semi-annual sampling event.

The compound 1,4-dioxane was detected at high concentrations in groundwater samples collected from on-site well OW1, and ranged from 3,300 ug/l (estimated) during the November 2001 sampling event to 52,000 ug/l during the February 2003 semi-annual sampling event. The concentrations detected in deeper well OW1b were several orders of magnitude less, and ranged from 14 ug/l in August 2004 to 60 ug/l in August 2002.

1,4-dioxane was also detected in groundwater samples collected from well OW8 during the quarterly and semi-annual sampling events. Concentrations declined steadily from 1,000 ug/l in March 2002 to 180 ug/l in February 2003. Significantly increased concentrations were reported in samples collected from the well during test pumping at that location (2,600 ug/l during March 2003 and 2,700 ug/l during November 2003). The concentration declined to 210 ug/l in February 2004, and increased to a maximum of 5,300 ug/l during the August 2004 sampling event. It is not known if installation and development (including pumping) of well OW8b during the period from August 16 to August 20, 2004 may have impacted the August 24th sampling results.

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Relatively low concentrations of 1, 4-dioxane were detected in groundwater samples collected from wells OW2, OW3 and OW4a, with maximum detected concentrations of 12, 16, and 14 ug/l, respectively. 1,4-dioxane was not detected in deeper wells OW4b and OW8b. As was observed for chlorinated VOCs, 1,4-dioxane concentrations were observed to decline with increased depth and distance downgradient from the Site.

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3.3.5 Biodegradation/Natural Attenuation Parameters

As discussed previously, various biodegradation/natural attenuation parameters were analyzed during the most recent semi-annual sampling event in February 2003. Analysis was performed in the field using field test kits and direct reading instruments, and also by an off-site laboratory. Laboratory results are summarized in Table 3-8, with field results summarized in Table 3-9.

Laboratory Results

Nitrate concentrations ranged from 11 to 8.8 milligrams per liter (mg/l) in samples collected from the water table wells (OW1, OW2, OW3, OW4a, and OW8) to 2.7 mg/l in deeper well OW1b. Nitrate was not detected in deeper well OW4b. Nitrite was detected at a concentration of 1 mg/l at one well location (OW1b).

In accordance with the criteria specified in Section 2.2, samples for methane, ethane, and ethene analyses were collected from water table wells OW1 and OW8, and deeper well OW1b. Concentrations in well OW1 were 4.8 ug/l; 3,200 nanograms per liter (ng/l); and 1,400 ng/l, respectively. Concentrations in deeper well OW1b were 2,400 ug/l; 480 ng/l; and 1,500 ng/l, respectively. Concentrations in well OW8 were 4.7 ug/l; 36 ng/l; and 1,000 ng/l, respectively.

Field Results

As shown in Table 3-9, electrical conductivity measurements ranged from 1,140 micromhos per centimeter (umhos/cm) at well location OW1b to 1,676 umhos/cm at well location OW8. pH measurements ranged from 6.73 at well location OW1 to 7.30 at well location OW4b. Dissolved oxygen measurements for samples collected from source area wells OW1 and OW1b were less than 1 parts per million (ppm). Redox potentials were negative at locations OW1, OW1b, OW4b, and OW8. Carbon dioxide was detected at all sampled locations except for well OW4b. Ferrous iron was detected at well locations OW1, OW1b, OW3, and OW8. Sulfate concentrations ranged from 162.5 mg/l (OW1) to 475 mg/l (OW1b). Chloride concentrations ranged from 26.25 mg/l (OW3) to 72.5 mg/l (OW8).

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3.4 Soil Sampling Analytical Results

A total of 33 soil samples for laboratory analysis were collected from borings GP1 through GP8 during the drilling program described in Section 2.3 of this document. Analytical reports are provided in Appendix D, with a summary of all detected compounds provided in Table 3-10. The MIP screening results are also provided in Appendix D.

PCE was detected most frequently and at elevated concentrations at all of the sampled locations. At location GP3A, PCE concentrations decreased from 3,200 ug/kg at a depth of 10 feet bgs to 130 ug/mg at a depth of 32 feet bgs. PCE then increased to reach a maximum concentration of 12,000 ug/kg at a depth of 65 feet bgs. 1,4-dioxane concentrations at this location decreased in the interval from 10 to 32 feet bgs (from 10,000 to 300 ug/kg), and declined to non-detectable levels from 45 feet to the bottom of the boring at 85 feet bgs. It is likely that this former UST area was a source area for spills or leaks from the former UST. The increase noted at 65 feet bgs is likely the result of contaminants migrating from contaminated groundwater to the capillary fringe during times of rising water levels.

3.5 Aquifer Testing

From March 10 through March 14, 2003, CDM conducted four single borehole pumping tests at wells OW2, OW3, OW4a, and 8. Each test was approximately four-hours in duration. CDM used an In-Situ Mini-Troll™ datalogger/sensor to monitor water levels at logarithmic intervals in the pumping well during the test activities. CDM also collected manual water level measurements prior to, during, and after the testing period in the pumping well and closest observation wells. During November 2003, longer-term constant rate pumping was performed at well OW8. The newly-installed piezometers and nearby wells were utilized as observation wells.

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CDM metered the discharge during each test and collected totalizer readings at the beginning and end of the pumping period. Due to some flow adjustments made during testing, a constant discharge rate was difficult to maintain at the locations of OW2, OW3, and OW4a. Totalizer readings were used to estimate the average pumping rate for the entire test period. Therefore, the average pumping rate calculated from the totalizer readings may not reflect the true rate at any specific period during the test. As discussed previously in Section 2.1.2, groundwater samples were collected for laboratory analysis immediately prior to the termination of pumping at each tested well location. The analytical results of samples collected during aquifer testing are discussed below.

3.5.1 Water Quality Sampling and Analysis

As previously discussed, water quality samples for laboratory analysis were collected just prior to the termination of pumping at all well locations which were test pumped during March 2003 (OW2, OW3, OW4a, and OW8) and November 2003 (OW8).

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VOC concentrations in samples collected from wells OW2, OW3, and OW4a during March 2003 were generally comparable to concentrations detected during the February 2003 semi-annual sampling event. Concentrations of PCE, TCE, 1,1-DCE, 1,1-DCA, 1,2-DCA, and CFM detected in samples collected from well OW8 were generally two to three times higher during March 2003 compared to February 2003. 1,1,1-TCA concentrations in well OW8 increased approximately an order of magnitude from February 2003 to March 2003. Freon 113 and Freon 11 concentrations

in well OW8 were comparable during the two sampling events. The concentration of toluene in well OW8 was approximately 20 times higher during March 2003.

The concentration of 1,4-dioxane in the sample collected during March 2003 from well OW8 was 2,600 ug/l, an approximate order-of-magnitude increase compared to the February 2003 result of 240 ug/l. A duplicate sample collected from well OW8 also reported a 1,4-dioxane concentration of 2,600 ug/l. The concentrations of 1,4-dioxane in the other three test pumped wells (OW2, OW3 and OW4a) during March 2003 remained relatively low or non-detected, and were not observed to increase compared to the February 2003 results.

Similar concentration increases were also noted during the November 2003 sampling event which followed approximately 20 hours of pumping at well OW8. There are several possible reasons for the observed increases in well OW8 during the March and November 2003 sampling events. The higher levels were observed after well OW8 had been pumping at an increased rate, likely drawing from areas of higher mass closer to the source area on the site. During March 2003 aquifer testing, for example, well OW8 was pumped at approximately 10.4 gallons per minute (gpm) for 4 hours, with approximately 2,500 gallons of groundwater pumped from the well. During routine groundwater sampling one month earlier in February 2003, the well was purged at approximately 3 gpm for 40 minutes, with a total purge volume of 117 gallons. It is also possible that variations in sampling equipment could have had some effect on the sample. The sample collected immediately prior to the termination of aquifer testing was collected directly from the discharge line. The sample collected during routine groundwater sampling was collected using a disposable bailer lowered to the middle of the perforated section after the portable pump had been removed from the well. This is the standard USEPA-approved procedure which is utilized during routine groundwater sampling of Omega wells. In addition, as discussed below, well OW8 appears to be located within a higher-permeability channel-like deposit which may be more hydraulically connected to higher mass, upgradient areas than wells OW2 and OW3. Another explanation for the increased concentration is that a cross-gradient portion of the plume may have been tapped via a preferential groundwater flow pathway, such as the sand channel, due to changes in the flow field during the test.

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3.5.2 Evaluation of Aquifer Parameters

CDM evaluated aquifer properties from the results of the four single borehole pumping tests and one multiwell aquifer performance test by analyzing the pumping test drawdown and recovery curves in accordance to the methods described in the CDM Aquifer Hydraulic Tests Standard Operating Procedure (SOP-FL-010) (CDM, July 15, 1993). Table 3-11 summarizes the test results and aquifer properties estimated from the various analyses that were performed. A description of each of the aquifer properties and methods used to estimate the aquifer parameters are provided below.

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Drilling logs and well construction details are included in Appendix A and described in Section 3.1. For the purpose of analyzing the pumping test data, CDM reviewed the well logs and water level data to estimate the saturated thickness of the aquifer at each well location. Based on this review it appears that although the aquifer is overlain by about 50 feet of silty clay at the site, it is not completely saturated and, therefore, the shallow groundwater is considered to occur under water table (unconfined) conditions.

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Transmissivity represents the capacity of the full aquifer thickness to allow passage of water. It is estimated using pumping test drawdown and recovery measurements. CDM estimated transmissivity from the pumping test data using manual straight-line curve matching based on the Cooper-Jacob solution as outlined in SOP-FL-010 for the single borehole tests. Figures E-1 through E-4 show the time-recovery plots for each of the single borehole pumping tests and the straight-line curve used to estimate transmissivity based on the Cooper-Jacob method. The Theis equation and all derivations used (Cooper-Jacob, t/t') for analyzing the pumping tests are based on assumptions summarized in Driscoll (1986). The values estimated using the recovery data at the pumping well may be impacted by well losses and dewatering of the aquifer near the well.

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Well OW2 was pumped at a rate of 2.3 gpm for a four hour period. The recovery curve shows the typical shape, with recovery to near the original level in a short period. The slope of the later portion of the recovery curve (small t/t' values) was used to estimate the transmissivity, which was 170 ft² /day. Well OW3 was tested at a rate of 1.3 gpm for four hours. This test could not be analyzed due to the short recovery period that was monitored. The sustained production rate suggests that the transmissivity is lower than that observed at OW2. Well OW4a was pumped at 10.3 gpm for four hours. The recovery was rapid and returned to the pre-pumping level. The slope on the later portion of the curve resulted in a transmissivity estimate of 2691 ft² /day. Well OW8 was pumped at 10.4 gpm for four hours. The recovery curve does not return to pre-pumping levels, with about 7 feet of drawdown at the end of the recovery period. The shape of the recovery curve was as expected, and yielded a transmissivity estimate of 1616 ft² /day. This estimate is considered uncertain due to the high remaining drawdown at the end of the test.

A multi-well test was conducted by pumping OW8 and monitoring the response at wells OW1b, OW2, OW3, OW4a, OW7, and OW8, and piezometers PZ-1 and PZ-2. The water level plots are provided in Appendix E. Well OW8 is screened across the entire saturated thickness of the upper aquifer, in the area where a lower permeability unit occurs within the aquifer. Groundwater occurs under water table conditions in this area, so an analytical method appropriate to unconfined conditions was chosen. The Neuman (1972) method of analysis for unconfined aquifers was selected. Many of the monitored wells did not have significant drawdown and could not be analyzed in a quantitative manner. Wells OW4a and OW7 were not impacted by the test, since they are located far from the pumping well. Wells OW2 and OW3 showed a possible response to pumping, but the magnitude was too small for quantitative analysis. Well

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OW2 did not show any recovery after the pumping phase, suggesting that the water level decline observed during pumping may be coincidental. Well OW3 did show a small recovery after pumping, but the magnitude of the recovery was much lower than would be anticipated. Piezometers PZ-1 and PZ-2 showed good response to the test and were analyzed using the Neuman method. Well OW1b was measured manually using a wireline probe. This well follows a trend similar to that observed at the pumping well, however, this appears to be coincidental and unrelated to the pumping test. Well OW1b is screened below the elevation of OW8 in a silt and clay zone and is 220 feet from well OW8. The magnitude of the apparent response is small (about 0.1 foot) and was determined from sparse manual measurements. Since this well is screened in very low hydraulic conductivity material that lies below the upper aquifer materials pumped at OW8, the response at this well, though uncertain, does not appear to be related to the testing at OW8.

Well PZ-1 is located 48 feet from OW8, and exhibited a maximum drawdown of 0.49 feet. The drawdown curve is provided on Figure E-5, along with the fitted curve and aquifer parameters associated with the curve. Calculations for the Neuman curve fits were facilitated using the commercial software package AquiferWin32. The analysis at PZ-1 resulted in an estimate of 563 ft²/day for transmissivity. Well PZ-2, located 53 feet from the pumping well, exhibited a maximum drawdown of 0.27 ft. Figure E-6 shows the drawdown and analysis for this well. The estimated transmissivity at PZ-2 was 810 ft²/day. Based on the thickness of productive sand intervals at these wells, the hydraulic conductivity of these sands is estimated to range from 50 to 100 ft/day, for purposes of estimating velocities in the aquifer. Estimates of the specific yield were also determined during the test, and ranged from 0.09 to 0.2. The test was likely not long enough to obtain a reliable estimate of the specific yield. As previously discussed, all pumped water was contained in a portable storage tank for disposal at an off-site facility. It was, therefore, not practical to conduct a longer-term pumping test.

Background water levels were monitored at wells OW1, OW1b, OW4a, OW4b, OW7 and OW8 in March and April, 2004. Hydrographs of relative water level fluctuation for each of these wells are provided in Appendix E. Wells in the upper aquifer (OW1, OW4a, OW8 and OW8) indicated falling water levels, while the deep zone wells showed rising water level trends. The magnitude of the daily fluctuations was very small.

3.6 Quality Assurance/Quality Control and Data Validation

A variety of Quality Assurance/Quality Control (QA/QC) samples (e.g., duplicates and equipment blanks) were collected during groundwater sampling. In addition, double or triple volume for laboratory QC samples (Matrix Spike/Matrix Spike Duplicate [MS/MSD]) were also collected and submitted to the laboratory. QA/QC sample results are included in the analytical summary tables.

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<#>All water removed from the well comes from aquifer storage.¶
<#>The water table has no slope.¶
The assumptions of the Theis equation and its derivations are based on an idealized setting for a pumping test. The hydrogeologic setting and well characteristics at the Omega site do not comply with the assumptions in the Theis equation as follows:¶
<#>The water bearing formation does not appear uniform and homogeneous both vertically and aerally. Based on the analysis of the testing data, the aquifer's transmissivity appears to vary across the site and reflect a permeable channel-like feature that trends from OW8 in a NE to SW direction. This channel is no wider than about 120 feet in the NW and SE directions from OW8 based on the lithology description and calculated hydraulic conductivities of OW2 and OW3. ¶
<#>The water bearing formation receives recharge from local precipitation. ¶
<#>The pumping wells do not appear to be 100-percent efficient ¶
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The laboratory provided both hard copy and electronic results. Electronic results were imported directly into the project's Access database. All laboratory analytical data generated during the groundwater monitoring events were reviewed and evaluated to ensure that they were usable and met the project objectives prior to incorporating the data into the database. To this extent, USEPA's Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review (USEPA, 1999 and 2002, respectively) were used in conjunction with the project work plan to assess overall analytical data quality.

Level IV data packets (CLP-Like) were requested for one sample group per groundwater monitoring event, which was subjected to formal data validation. A sample group consists of all samples collected on a single day and submitted to the analytical laboratory on an individual COC. Although a target validation frequency of 10 percent was proposed in the project work plan, the actual percentage was much greater and ranged from approximately 30 percent to nearly 70 percent depending on the analysis validated. The sample group selected for validation was based on the number and type of samples collected and the type of analyses requested. In other words, the sample group selected for validation contained the largest number of samples collected in one day and submitted for analysis of the greatest variety of parameters in order to provide the most comprehensive level of validation. A sample matrix is provided as Table H-1 (included with Appendix H), which summarizes the number and types of samples collected each day and identifies the samples that were formally validated. Data validation reports are included in Appendix H.

All other Laboratory data that were not subject to formal validation were reviewed for data usability and for inclusion and frequency of the necessary QC supporting information. Supporting QC documentation that were evaluated for each analytical report included the following major items:

- ± sample holding times
- ± method blanks
- ± matrix spike/matrix spike duplicate (MS/MSD) recoveries
- ± relative percent difference (RPD) between MS and MSD
- ± laboratory control sample (LCS) recoveries
- ± surrogate recoveries (organic analyses)
- ± field quality control sample results

Prior to incorporating the Omega analytical data into the database, the electronic data were checked for accuracy against the hard copy analytical reports. Standard procedure includes contacting the laboratory in the event that discrepancies are discovered, resolving and correcting discrepancies, and reissuing the analytical

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reports, as necessary. Data validation reports for seven Level IV data packets (November 2001, February 2002, August 2002, February 2003, August 2003, February 2004, and August 2004) are presented in Appendix H. No significant QC issues were noted during the review process; therefore, with two minor exceptions, all data can be used for project purposes without qualification. The exceptions are the 1,4-dioxane result (1.6 ug/l) for well OW3 during August 2003, and the MC result (1.2 ug/l) for well OW1b during August 2004. Both results have been qualified in the database (and shown on the analytical summary tables) as "UB", indicating that the result was not detected due to the detection of the analyte in the laboratory method blank.

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Section 4

Conclusions and Recommendations

Based on evaluation of the historical and recently-acquired lithologic, water level, analytical, and aquifer testing data, the following conclusions and recommendations are provided.

4.1 Conclusions

Conclusions regarding groundwater flow direction, groundwater sampling results, and fate and transport of compounds detected in groundwater in the Phase 1a area are presented below.

4.1.1 Groundwater Flow Direction and Gradients

Monthly and semi-annual water level monitoring performed to date indicates a consistent groundwater flow direction towards the southwest in the water table zone. Hydraulic gradients upgradient of cluster well OW4 were consistently steeper than the gradients observed downgradient of the well cluster (0.01 ft/ft vs. 0.002 ft/ft and 0.003 ft/ft). In addition, water levels have generally been declining throughout most of the monitored period. Also, as water levels have dropped over time in wells OW1/OW1b and OW4a/OW4b, the differences in head between the monitored zones have increased at both locations. During the most recent August 2004 sampling event, the head difference between the OW1/OW1b well pair was 9.28 feet, with a head difference of 8.99 feet observed at the location of well pair OW4a/OW4b. The difference in head at location OW8/OW8b during August 2004 was 17.4 feet.

4.1.2 Groundwater Sampling Results

Chlorinated VOCs have been detected more frequently and at elevated concentrations in the Phase 1a area, therefore, they are the primary compounds of concern. Based on observations at two locations where a water table and deeper well pair are present (OW1 and OW1b, and OW4a and OW4b), chlorinated VOC concentrations were observed to decline with depth and appear to be of limited vertical extent. Concentrations were also observed to decline with increased distance downgradient from the Site. Aromatic organics, semi-VOAs, pesticides, and metals were detected sporadically and at relatively low concentrations in groundwater samples collected from the Phase 1a area wells, therefore, they are not considered compounds of concern.

Based on evaluation of the lithologic, aquifer testing, and groundwater sampling results, there appears to be a higher-permeability area (possibly a channel deposit) immediately downgradient of the Site in the vicinity of well OW8 on Putnam Street. Relatively higher (compared to well OW2 to the north and well OW3 to the south) VOC and 1,4-dioxane concentrations were also detected in this area.

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4.1.3 Soil Sampling Results

Soil sampling results indicate the presence of a contaminant source at the location of the former UST. Soil contamination was also observed associated with contaminated groundwater and the capillary fringe.

4.1.4 Fate and Transport

Groundwater sampling results indicate that the highest contaminant concentrations are associated with the former source area locations that are upgradient of Putnam Street, and that this contamination is predominantly limited to the shallower portions of the aquifer. These contaminants include various chloroethene parent compounds (PCE and TCE) and their primary daughter product pathways (cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride [VC]); chloroethane parent compounds (PCA, 1,1,1-TCA, and 1,1,2-TCA) and their daughter products (1,1-DCA, 1,2-DCA, and 1,1-DCE [abiotic hydrolysis of 1,1,1-TCA]); chloromethanes (CTC, CFM, and MC), and freons.

The highest VOC concentrations are found within the shallow groundwater plume as evidenced by data from well OW1 (screened from 62.5 to 77.5 feet bgs) during the August 2004 semi-annual sampling event. In particular, the data indicate elevated concentrations of the parent-compounds PCE (150,000 ug/l) and 1,1,1-TCA (12,000 ug/l), with TCE (3,500 ug/l) and 1,1-DCE (2,000 ug/l) present at substantially lower concentrations and likely as biotransformation daughter-products, respectively. The concentration of PCE detected at monitoring well OW1 (150,000 ug/l) represents 75 percent of the aqueous solubility of PCE (200,000 ug/l) and therefore provides strong evidence for the presence of a dense non-aqueous phase liquid (DNAPL) within this area of the Site. Conversely, groundwater data from monitoring well OW1b (screened from 110 to 120 feet bgs), which is screened in the deeper groundwater plume, during the August 2004 semi-annual sampling event indicate only minimal VOC detections at this deeper interval (PCE concentration of 87 ug/l; TCE concentration of 2.8 ug/l; and 1,1-DCE concentration of 2.2 ug/l), and aquifer characteristics that limit the vertical migration of contamination in this area.

Groundwater data collected from monitoring wells located downgradient of the source areas indicate a trend towards decreasing total VOC concentrations within the shallow groundwater plume, with increasing fractions of daughter products relative to the parent compounds along a defined contaminant flow path. To facilitate the analysis of VOC trends, two subsets of contaminants (chloroethenes and chloroethanes) and their degradation daughter products were identified. Monitoring wells OW1, OW8, and OW4A are located along a general hydraulic flow path in the shallow hydrologic zone, and this group of wells was used to evaluate the contaminant transport trends. Well OW5, which is located downgradient from Washington Boulevard wells OW4a and OW4b, is also included in this evaluation. VOC concentrations within both subsets were converted to units of molar concentration by dividing each chemical concentration by its respective molecular weight. For those chemicals below the reporting limit, a value equivalent to one half

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of the reporting limit was applied. The results of this analysis are presented in Table F-1 and Figures F-1 and F-2 in Appendix F.

The summation of chloroethenes along the defined flow path, along with the ratio of sequential dechlorination daughter products are depicted in the table. As shown in the table, the total molar concentration of chloroethenes decreases along the flow path from 205 umoles/L (OW1) to 0.5 umoles/L (OW4A), with a subsequent increase to 13.4 umoles/L at OW5. These data suggest an attenuation of contaminant mass along this flow path with an increase of mass at the furthest downgradient well (OW-5).

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The apparent decrease in contaminant concentrations along the defined flow path provides supporting evidence of contaminant attenuation with distance traveled from the source area, whereas the increase in contaminant mass measured at OW-5 may be attributed to commingling groundwater contaminant plumes from more than one source. Furthermore, the ratio of PCE/TCE and TCE/cis-1,2-DCE decrease along this flow path suggesting limited, active biotransformation of parent compounds to daughter products may be occurring along the defined flow path. It is important to note, however, that these conclusions are preliminary because they assume that the monitoring well network is hydraulically connected along the full length of the groundwater plume and that the network of monitoring wells provides a complete and accurate depiction of the contaminant travel path; the validity of these conclusions are weakened by the potential for tortuous flow paths and the presence of sand channels that may act as preferential contaminant flow paths.

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The attenuation of chloroethane contaminants and their daughter products with distance traveled along the defined flow path in the shallow groundwater plume are presented in Table F-1. Similar analyses for the other subsets of contaminants were not performed due to the frequency of values below the reporting limits. The transient spike in the 1,1,2-TCA/1,2-DCA ratio is the result of concentrations below the reporting limits for both chemicals.

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Estimates of the advective groundwater transport and contaminant migration velocities (V_A and V_C , respectively) are presented in Table F-2. Due to unique hydrogeologic properties encountered in the shallow hydrologic zone, the defined flow path from monitoring wells OW-1 to OW-5 is segregated into three "Segments" for the purposes of this evaluation. The area between monitoring wells OW-1 and OW-8 is defined as Segment 1; the area between monitoring wells OW-8 and OW-4B is defined as Segment 2; and the area between monitoring wells OW-4B and OW-5 is defined as Segment 3. Estimates of V_A and V_C are presented separately for three "Segments" along the defined flow path, and the minimum and maximum transport times for groundwater and contaminants to travel along each individual Segment are presented in Table F-2. The minimum transport times for groundwater and contaminants to travel along the full length of the defined flow path (i.e., Segments 1 through 3) are 12.0 and 22.5 years, respectively; whereas the maximum transport times along this same flow path are 22.1 and 41.6 years, respectively. These estimates

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of potential transport times are generally consistent with available information on the historical operations at the site.

Despite the active dechlorination processes inferred from the above analyses, the dechlorination of the parent chloroethene and chloroethane contaminants appears to stall at intermediation biotransformation daughter products. This conclusion is supported by the relative abundance of the parent contaminants compared to their daughter products at all monitoring wells along the defined flow path. Under the proper groundwater environments, PCE may be sequentially biotransformed to TCE, cis-1,2-DCE, VC, and ethene/ethane, which are the terminal dechlorination products under reduced groundwater environments. Similarly, the TCA isomers may be sequentially biotransformed to DCA isomers, chloroethane, and ethane, while 1,1-DCE may be formed during abiotic hydrolysis of TCA. VOC data collected during August 2004 indicate that that VC and chloroethane were not detected above the reporting limits (0.5 ug/L) at any of the OW-1 through OW-8 monitoring locations. Furthermore, the intermediate chloroethene and chloroethene daughter products (cis-1,2-DCE and DCA/1,1-DCE, respectively) were generally below their respective reporting limits, or detected at concentrations that are substantially lower than their parent compounds. These findings suggest that the aquifer characteristics are not ideal for promoting the rapid and complete sequential dechlorination of the parent contaminants.

Biodegradation/natural attenuation data collected during February 2003 indicate that significant dechlorination to innocuous end products for the chloroethene contaminants (e.g., ethene) and chloroethane contaminants (ethane) is not evident.

Low concentrations of ethene at source area monitoring well OW1 (1.4 ug/l) and OW8 (1.0 ug/l) suggest limited potential for complete detoxification of the chloroethene contaminants through the reductive (anaerobic) pathways considered in this evaluation (see Tables 3-8 and 3-9 for biodegradation and natural attenuation results). Similarly, low concentrations of ethane at source area monitoring well OW1 (3.2 ug/l) and OW8 (0.036 ug/l) suggest limited detoxification of the chloroethane contaminants through reductive dechlorination processes. Limited detoxification of the chloroethene and chloroethane contaminants through reductive processes is likely due to the absence of sufficient electron donor compounds (i.e., typically measured as DOC) to drive the groundwater environment to highly reduced conditions (e.g., sulfate reducing and methanogenic) and provide the necessary source of energy to fuel contaminant dechlorination reactions. The presence of elevated DO concentrations recorded in February 2003 at OW-8 (1.57 mg/L) and OW-4A (3.29 mg/L), and elevated nitrate concentrations at OW-4A (11 mg/L), suggests the presence of oxidized groundwater reducing environments and electron acceptors that compete with the dechlorination of the chloroethene and chloroethane contaminants. Sulfate data collected in February 2003, which also competes with the contaminant dechlorination reactions, were elevated and ranged from 162.5 mg/L to 347.5 mg/L at the OW-1, OW-4A, and OW-8 monitoring wells.

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The occurrence of these competing electron acceptors may be overcome through implementation of active remediation systems that can reduce the concentrations of these naturally occurring compounds and provide the necessary energy to promote the rapid and complete detoxification of the chloroethene and chloroethane contaminants. While biodegradation of some VOC daughter products (e.g., VC and chloroethane) to innocuous carbon dioxide may also occur through oxidative processes under aerobic and iron-reducing conditions that were not discussed in this section, the ability for such reactions to provide a meaningful approach to remediation would require an abundance of daughter products relative to parent compounds since the parent compounds and some intermediate compounds (e.g., PCE, TCE, cis-1,2-DCE, and DCA) generally persist under oxidized environments.

In summary, results from this screening level evaluation of intrinsic biotransformation processes suggest that active dechlorination of the primary chloroethene and chloroethane contaminants is occurring; however, complete and rapid detoxification of these contaminants is not evident from the existing data set. Furthermore, while limited detoxification of these contaminants may be occurring through reductive dechlorination processes, as evidenced by the low concentrations of ethene and ethane, the significance of these dechlorination reactions appears to be limited by absence of highly reduced groundwater environments and absence of significant electron donating compounds. While limited detoxification of these contaminants through oxidative processes is possible, the ability of oxidative processes to provide a meaningful approach to remediation is limited by the presence of higher chlorinated contaminants that do not readily biotransform under oxidized environments. Future design of remediation systems to address the chloroethene and chloroethane contaminants should consider biologically-mediated systems that are capable of achieving complete detoxification of these contaminants in-situ, thereby limiting risks associated with other technologies in which contaminant mass is transferred from one media to another.

4.1.5 Aquifer Characteristics

Single borehole and multi-well aquifer tests were conducted during these investigations. Reliable estimates of transmissivity were obtained for the upper aquifer in wells along Putnam Street. The most reliable estimates were obtained from the multi-well test. The upper aquifer transmissivity in this area ranged from 563 to 810 ft²/day. Transmissivity increases in the downgradient direction, with a value of nearly 2,700 ft²/day estimated at OW4a.

4.2 Recommendations

Earlier conceptual designs for the groundwater treatment plant considered treatment for VOCs only. With the detection of relatively high concentrations of 1,4-dioxane in the on-site source area well (OW1) and elevated concentrations in the downgradient Putnam Street well (OW8), additional treatment requirements need to be considered. The compound 1,4-dioxane is not readily strippable or absorbed by granular activated

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OPOG will submit a scope of work to USEPA for review and comment prior to implementation of the proposed field work. The scope of work will include a map showing proposed soil sampling locations. Upon completion of the field work, OPOG will prepare a brief technical memorandum for submittal to USEPA summarizing the findings of the investigation. ¶

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carbon (GAC), therefore, alternative treatment methods (e.g., ultraviolet-oxidation [UV-OX]) need to be evaluated to address the detection of this compound.

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Section 5

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Appendix A

Boring/Well Construction Logs, MIP Screening Results, and Electric Logs

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Appendix B

Completed Field Forms

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Appendix C

Well Survey Data

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Appendix D

Analytical Reports and COCs

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Appendix E

Aquifer Test Data

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Appendix F

Fate and Transport

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Appendix G

Hydrographs and Time-Series Plots

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Appendix H

Data Validation Results

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The water-bearing formation is uniform in character and the hydraulic conductivity is the same in all directions.

The formation is uniform in thickness and infinite in areal extent.

The formation receives no recharge from any source.

The pumped well penetrates, and receives water from, the full thickness of the water-bearing formation.

The water removed from storage is discharged instantaneously when the head is lowered.

The pumping well is 100-percent efficient.

All water removed from the well comes from aquifer storage.

The water table has no slope.

The assumptions of the Theis equation and its derivations are based on an idealized setting for a pumping test. The hydrogeologic setting and well characteristics at the Omega site do not comply with the assumptions in the Theis equation as follows:

The water bearing formation does not appear uniform and homogeneous both vertically and aerally. Based on the analysis of the testing data, the aquifer's transmissivity appears to vary across the site and reflect a permeable channel-like feature that trends from OW8 in a NE to SW direction. This channel is no wider than about 120 feet in the NW and SE directions from OW8 based on the lithology description and calculated hydraulic conductivities of OW2 and OW3.

The water bearing formation receives recharge from local precipitation.

The pumping wells do not appear to be 100-percent efficient.

The water table across the site has a gradient of about 0.008 ft/ft.

A break from the assumptions can result in variable differences between the actual and calculated transmissivity and hydraulic conductivity values. CDM addressed this in the following manner:

The analysis was conducted on the pumping well and the radial distance to the observation point was considered to be equal to the well casing radius (0.2 feet) making effects from the ground water gradient negligible.

Additional transmissivity estimates are obtained from the recovery curve for each test, thereby removing the factors of pumping efficiency and well storage effects because the well is not pumping. Recovery water levels are returning at a rate allowed by the hydraulic characteristics of the aquifer.

The calculated transmissivities are combined and averaged from the Theis analysis and its derivation (Cooper-Jacob) for each well.

The short 4-hour testing duration is to unlikely show affects from local recharge events.

The recent testing analysis indicates that lower permeability portions of the aquifer at well locations OW2 and OW3 have average transmissivities that range between 10 and 90 square feet per day (ft^2/day) while more permeable portions of the aquifer at well locations OW8 and OW4A have average transmissivities that range between 400 and 4,500 ft^2/day .

Storage coefficient is the volume of water taken into or released from storage per unit change in head per unit area (Driscoll, 1986). Storage coefficients are lower in confined aquifers than in unconfined. This is because, in confined aquifers, pressure is reduced in the aquifer, but the aquifer is not dewatered. Typically, storage coefficients range from 0.01 to 0.30 for unconfined aquifers and 0.001 and lower for confined aquifers. A storage coefficient for the aquifer underlying the Omega site could not be determined using the

recent pumping test data because the observation wells monitored during each test did not respond to the pumping.

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